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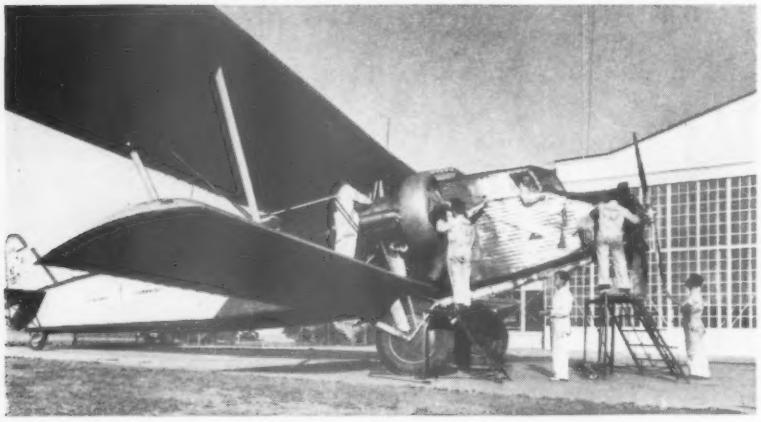
A Transport Acts as Classroom

by ROGER FOLWELL



The students are tuning up the Boeing No. 80, gaining additional experience in addition to the experience in practical navigation.

DON'T let anybody tell you differently. Six thousand miles across the continent and back again in a trimotor, pounding ahead through snow, navigating by instruments and radio, staying on-course while flying "over the top," making night landings and observing faithfully the necessary traffic regulations gives you a better idea of what airline flying is all about than a thousand lectures.

I had flown on private flights, "under the hood" and on cross-country trips out on the Pacific coast, but to fly an airline schedule, navigating, standing engineering watch and piloting under the various conditions you find along the airway between Oakland and Newark—well, that's the ultimate in flight training.

The Boeing 80 used on this trip is a fourteen place tri-motored biplane weighing almost eight tons. It is powered by three 450 horsepower Pratt and Whitney Wasps and is capable of a 125 mph. cruising speed. This type of ship was used on United Air Lines for four years, from 1929-1933; whereupon it was superseded by the present Boeing 247-D. In contrast, the 247-D is capable of carrying ten passengers at 190 miles per hour with only two motors, all of which speaks well for the advancement of airline equipment.

In the past, students at the Boeing School of Aeronautics had made cross-country trips of various distances, but those hops were limited to western and mid-western cities, such as Portland, Seattle, Los Angeles and Chicago. When the subject of a longer flight was broached this spring we seven students who were slated to go agreed unanimously that we'd like to fly the large Boeing 80 on an airline schedule, night and day, clear across the continent, despite threatening weather conditions of the season.

"On schedule" does not mean that we made the entire trip without time for sleep and rest, but rather that we followed all the rules of United Air Lines on the ground and in the air. In short, we were professional pilots for the duration of the flight.

"Weather," as older pilots know it, means something more than sunshine and fair winds. A long-distance training flight fails to accomplish its purpose unless you have some more difficult problems than sunshine and a full moon present. We had a few—snow for instance—and storms. Yet we pushed ahead much after the manner of an airline schedule, making full use of the United Air Lines' frequencies via two-way radio and their facilities.

In the school we had had our fair share of flying and beam flying by instruments under the hood and the usual routine leading up to the transport license. But all that had been largely in our own back yard, so to speak. Here we got into strange territory. We learned many things during 48 hours of flying that all the talking in the world would not have impressed upon us.

This system of having constant two-way contact with the ground is certainly reassuring to the pilot, as I learned during the last hour into Cleveland and again when flying "over the top" westbound between Cleveland and Chicago. Constant information poured into our ears: weather, ceiling, position of other planes, everything that would make our flight safer.

Here's something maybe you don't know. When the airline sends through a student trip such as ours, it guards the ship and crew with regular half-hourly reports just as though our plane were on a regular passenger-mail schedule. Pilot or co-pilot gave these "PX" reports at definite times, according to the schedule on which we were flying.

By schedule I mean that, before we took off, we were told at what altitude to fly and when to report. Before each takeoff, too, the pilot read the complete route weather report and field clearance papers, and signed them! No shifting of blame back to the ground organization.

For instance, once we were put on the eleven schedule. That means, we reported at 00:11 and 00:41, or 11 minutes after the hour and half-hour. This was the co-pilot's job, and it was easy enough, provided he knew where he was. Since our chief pilot was George Meyers, chief flight instructor, and we were flying in ship No. 7135, here's the way a report would go:

Looking out through the right wing struts toward the Wasatch range near Coalville, Utah.

in Coast-to-Coast Flight

"Meyers—seven one three five—Blue Canyon—Blue Canyon—ten thousand five hundred—ten miles—hazy—fourteen thousand—high broken cumulus clouds—twenty-four degrees—slightly rough—all okay—go ahead."

In those few words, he reported his name and the plane's number, our position and altitude, visibility, ceiling and other conditions. That simple, but highly important in every-day airline operation, where nothing is left to chance.

But let's start at the beginning. After checking the weather, with Bob Fields at the controls for the first hour, we took off from Oakland on the first leg of our long trip, which was a gas stop at Reno. The weather reports between Oakland and Salt Lake gave visibility unlimited and few scattered clouds at 10,000 ft. along the whole route, with possible cloudiness and rain inside of next 24 hours due to a wind shift line moving in from northwest. Nevertheless, it was CAVU as far as general conditions went; so off we went.

As we took off shortly after 4:00 P.M., it wasn't long before darkness settled over the countryside; in fact the landing at Reno was made at dusk. The night flight from there to Salt Lake was a simple matter, due to the unlimited visibility which made possible seeing several beacons ahead with little trouble, a total distance of 65 to 70 miles.

With this lighted "highway" to follow and the radio range beam, there should be no excuse for even a student pilot flying for the first time at night to get off the course; in fact, odd as it may sound, it was far less confusing than flying over the same terrain by daylight. The flight covered some six hours, all of which was well spent by everyone aboard, and not just those two who were flying the ship.

While radio makes precision flying possible under adverse conditions, radio flying always depends upon the pilot's ability to use his instruments. Here, the students are studying instruments while in flight.

We did little loafing, even though the engineers and navigators had some time to enjoy the scenery. As there were seven of us, it was impossible to divide us evenly into separate groups to maintain the same schedule at all times; however, we managed very nicely by rotating partners at intervals.

Say, for instance, that Nat Paschall and Jack Peacock were flying pilot and co-pilot. When in the pilot's cabin they took care of the radio work and were responsible for staying on the course.

While the next pair to fly, say, Mills Hollinger and Dale Scott, would be keeping a constant check with them on the navigating, so as to know their terrain and to correct any faults of the two pilots.

The next in line—two from among Bob Fields, Bob Branson and me—would be engaged as flight engineers, keeping a written report of the altitude, course, check on all engine instruments, position and weather. All this was gathered every half-hour. The seventh man would take care of the ship's log books.

At Salt Lake, we found it necessary to change frequency on the radios, over to Boeing night. Transcontinental radio systems, to avoid interference, are divided into four sections. So it was necessary for us to have our radio re-tuned at Salt Lake and Chicago. This took longer than expected at Salt Lake due to radio difficulties, so we were delayed about twelve hours. This was lesson Number One in airline flying. Now we understand more about the importance of radio than any number of lectures could convey.

The trip to Cheyenne, made the next day, was our first long flight over higher mountainous terrain. Climbing out of Salt Lake to cross over the Wasatch range, which looms over the city at an altitude of some 10,000 ft. above sea level, or about 5,000 above the field, seemed like an almost impossible feat, though the faithful 80 handled it very nicely.

It was on this short 380-mile journey that we made some of our best time. For a period of about an hour after passing Rock Springs we averaged close to 170 m.p.h., due to some pretty strong tail-winds at that altitude, which ranged around 65 m.p.h. at 12,000 ft.

These data we obtained from the weather bureau before taking off. The

The author (in center) studies a strip map with instructor George I. Meyers (left) and his co-pilot Mills Hollinger, before taking off in the trimotored classroom.

matter of winds aloft is a serious one, especially if you are figuring pretty closely on your gas supply, as you may have strong winds blowing at 180 degrees from each other at an interval of only 2,000 ft. of altitude. Moral: Always visit the weather bureau before taking off and don't hesitate to ask questions, especially if you are uncertain as to the meaning of the teletype symbols and code.

Our second night was spent at Cheyenne, due to more radio difficulties, though no one seemed to mind the chance to rest up a bit. The flight to Chicago was fairly long, but without incident because of the perfect weather along the route. A gas stop was made at Omaha, where we saw our first snow on the ground, outside of the mountains.

The snow was mostly melted, nevertheless we took care not to get off the runways because of the soft surface and our 15,000-pound plane. The landing at Chicago was made after dark, an experience to which we were getting accustomed.

The Chicago and Newark airports are reputed to be the two busiest in the country, all of which is easy to believe when you witness the number of airliners that land and depart every hour. Chicago has United Air Lines, American Airlines, TWA, Northwest, Chicago and Southern, and Eastern Airlines all coming into it, and maybe a few more. Due to this, great caution must be exercised when approaching the field, especially under adverse weather conditions. To partially remedy this, the Department of Commerce in its Airway Bulletin for scheduled operations, has printed an agreement by the airlines as to certain designated concentration points over which you must fly at a fixed altitude, and at a predetermined time.

This same procedure is used coming into Newark, where Martins Creek is used as the point of converging. The next day we completed the cross country part of the trip, by arriving at Newark, via Cleveland, after a very easy flight. The weather was slightly cloudy and quite smoky around Chicago and Cleveland, with visibility from three to four miles.

Coming over the Alleghenies it was hard to believe that those seemingly innocent hills could be responsible for so much trouble to flying in the winter season. On the way back we got a little taste of their storms, and consequently left with a feeling of respect, in spite of their clear weather appearances.

Two days later, on the flight back to Cleveland, we got our first tough weather. The weather bureau at Newark reported a low pressure area moving up through western Pennsylvania and Ohio, so we expected to encounter a wind shift line along with light icing conditions due to freezing rain, before we hit Cleveland. The first we got was between Clearfield and Brookville, Pa., while on the west leg of the Bellefonte beam. Due to heavy snow and static the radio became practically useless as far as reception was concerned so we were forced to rely on dead reckoning for a period of an hour.

Visibility was down to less than a mile for short periods, with rather heavy snow, though very little ice except on the windshield where it was more of a nuisance than a hazard. When we were about over Warren, Ohio, Cleveland radioed us to climb to 3,000 ft. and come in on instruments because of local traffic conditions.

As it was, we noticed a considerable temperature inversion in the overcast, which would have been very helpful if we were taking on much ice. After passing over the Cleveland cone, while on the beam, we were given local weather conditions, which were 1800 ft. ceiling and 3-mile visibility, Kollsman 29.61 and wind SW 12, all of which made the landing much simpler.

It chanced to be my turn at the controls when we ran into this thick stuff. At that precise instant I had had 21 hours and 24 minutes experience in instrument flying, including 20 hours on the Oakland beam. But home was no

(*Continued on page* 70)

Coming up to the "Hump" near Salt Lake City.

The Lawrence Sperry Yearly Award

The late Lawrence B. Sperry, a noted young inventor.

LAWRENCE BURST SPERRY, son of Elmer Ambrose Sperry, the noted scientist and inventor, was a pioneer in blind-flying and aerial navigation by instruments. Both the son and the father were noted for their activities in the development of gyroscopic controls and instruments.

Among his many achievements, were his blind flying experiments. He was the first pilot to fly "blind" with instruments and the first American pilot to make night flights. He designed and improved many airplane instruments including the drift-set, angle-of-incidence indicator, bank-and-turn indicator, the first improved airplane compass and servo-motor control with manual manipulation.

He met his death at the age of 30 years by drowning in the English Channel while attempting a crossing in a tiny flivver plane. It is in view of his youth that his remaining relatives evolved the idea of suitably awarding other young men of accomplishment in aviation science, thereupon establishing a fund of $10,000 of which an annual award of $250 will be made. The Award Committee for 1936 consists of Grover Loening, Glenn L. Martin, Charles L. Lawrence, Major James H. Doolittle, Elmer A. Sperry, Jr., and Major Lester D. Gardner.

A glider which he built in the attic of his father's house during the summer of 1910 and a second-hand automobile played important roles in developing Lawrence Sperry's interest in aviation. In 1911, using the old car as a tow for

(*Continued on page* 64)

A Scissors Type Convertible

It is our great pleasure to present a most remarkable type of plane which fills, in a most ingenious way, many of the demands made on a flying wing type aircraft. We will await with great interest, future developments along this line.

by E. C. STROOP

IMPROVEMENTS in airplane performance have steadily progressed, along but one line—that of speed. From a constructional or structural standpoint, however, we still have the old type airplane with its wings, tail, fuselage and ailerons but with a great many undesirable features added as the result of the present mania for high speed.

Each year sees some designer painfully squeeze out a few additional miles-per-hour by reason of added power or slightly decreased resistance, but when all is said and done we have little to boast about in the matter of low landing speeds, stability or other features associated with the cause of safety. Speed, speed and still more speed is the cry of the day with but little thought to the ultimate needs of aviation.

Many pilots, having tasted the bitter with the sweet, have found that the bad taste left in the mouth by the bitterness of high speed has not been counteracted by the feeble attempts at remedying the sweet of low speed landing. A bitter forced landing is never compensated for by a sweet high top speed. A hot landing is not excusable on the score of a 200 plus topper.

Now, in regard to that feeble search made for low landing speeds, we have successively dug up various makeshift expedients such as variable camber, variable angle of incidence and variable area attained by diminishing the area by the reefing process, but so far little has come from them from a practical standpoint. Sliding wing tips, flexible ribs and accordion pleated wing fabrics have all been thrown into the discard.

After carefully analyzing the various methods of increasing speed range via the perfection of low-speed landings, I found that two principal courses were open to me. First, the adoption of a better system of variable camber, which seemed the most effective and promising and, second, the adoption of some system of varying the area of the lifting surfaces which, at the time, seemed a rather remote possibility in view of what had already been done along this line by other investigators.

This led to much burning of the midnight oil and tossing of a weary head upon the pillows, but after several months of reflection, and after filling the waste-paper basket full of futile sketches, I felt that something was about to turn up—and it did. The sketches were again reviewed and all but those that showed at least two advantages were discarded.

And then I hit upon a scheme that sounded feasible, a plane with a variable area, but with fixed surfaces, and combined with this great advantage was an

The convertible plane with lifting surfaces extended to form a biplane structure.

The convertible plane with the lifting surfaces contracted into monoplane form for high-speed flight.

A mock-up of the convertible type plane which can be converted from a monoplane into a biplane, or vice versa, while in flight to gain better performance.

automatic retractable landing-gear. Coupled with the variable area and the automatic retractable landing-gear was an automatic dihedral angle control that seemed to offer great possibilities.

Then, after wrestling around on my drafting board, I evolved my S.P.-6 of which I built a wind-tunnel model just to find out how I agreed or disagreed with Nature's laws and the laws of physics. After making the tests in a crude wind tunnel, the design showed certain advantages but they also showed even a more striking proportion of disadvantages, so I hadn't gained very much net benefit.

And then to work again on my pet theme with tee-square and drafting board to crack the nuts that had presented themselves. A second design was laboriously worked out which naturally became the S.P.-7 which is shown in the accompanying photos as a possible and even probable answer to the age long wrestling match for a greater speed range.

Two of these photographs show the wind-tunnel model in various attitudes while a third photo shows the mock-up of my full-size convertible Biplane-Monoplane which has a possible speed range of from 45 to 400 m.p.h. when thoroughly developed together with a synchronized multiple thrust power unit which I will describe at a later date. This design utilizes a power-plant consisting of a single engine and a variable pitch propeller which, according to data received from my tests, should give a total range of variation amounting to 45 to 360 m.p.h.

The principal feature of my invention is the "dual airfoil" and the conformation of the upper half to the top camber of the wing and also, the lower half of the wing-section.

This makes possible, the combination of variable area and variable camber together with inherent lateral and longitudinal stability, when the wings are opened up for slow flight, cruising or landing. And, when the wings are closed, there is a reduction of area. The cambered undersurface of the upper half of the dual airfoil wing is sealed down over the top camber of the lower of the wing-section which action takes both of these surfaces out of action in the area and reduces the effective area about 50 percent.

This also eliminates plus camber and gives a cantilever speed-wing section fully capable of the estimated 400 m.p.h. with less power, lower fuel consumption and a greater cruising radius.

This plane is really two planes within one. For example, a heavy load of passengers can be taken off in a small airport with the wings fully opened. After reaching an altitude, say of 5,000 feet, the propellers would be set at their high angles and the plane put into a slight glide. The motors are then opened up wide after a speed of 120 m.p.h. is attained, and then the wing closing would be started and with the closing of the

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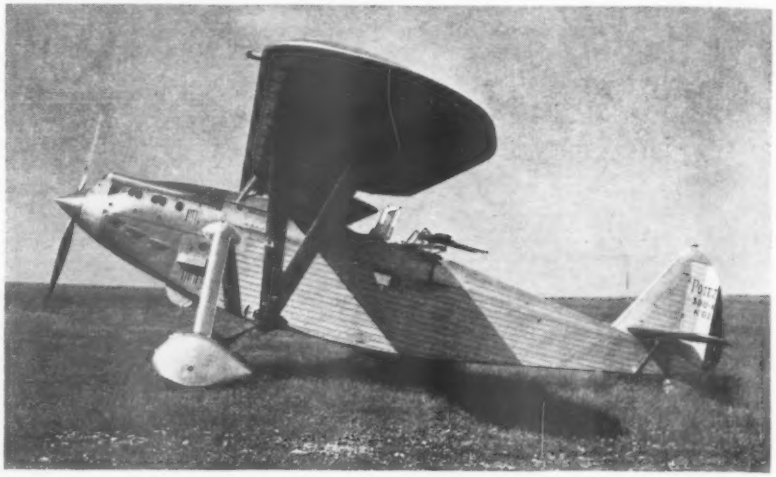
French Military Planes for Peruvian Forces



The Potez 39 day bomber that flies at a top speed of 183 m.p.h. at 16,400 feet. It climbs approximately 1,100 feet per minute.

THE PERUVIAN Government has recently received twelve Nieuport Type 121 fighters and fifteen Potez Type 39 day bombers. Both are quite interesting planes and show a remarkable performance.

The Nieuport Type 121 is powered with a Lorraine-Petrel engine rated at 720 horsepower. It is a 12-cylinder liquid cooled engine that drives the Nieuport at a top speed of 230 m.p.h., or, as it is said, is probably the fastest fighter in service. The Nieuport 121, equipped as a seaplane, is the speediest of the world's seaplanes. The top speed is attained at an elevation of 13,120 feet above sea level.

The Potez 39, which has also been delivered to the French army, is a two seater monoplane powered with the same Lorraine-Petrel engine as the Nieuport. It has a maximum speed of 183 m.p.h. at 16,400 feet and, with a total weight of 4,950 pounds, climbs to 16,400 feet in 10 minutes, 34 seconds. Both the Nieuport and the Potez, as delivered to the Peruvian Government, can be equipped with floats.

The Nieuport 121 fighter, built for the Peruvian Government, has a top speed of 230 m.p.h. and climbs at an approximate speed of 2,600 feet per minute.

An Electric "Ear" Now Available

A NEW sound level indicator has been announced by the Industrial Apparatus Co., 720 N. Wabash Ave., Chicago, Ill. It is designed to measure sound levels exactly as heard by the human ear.

The user can quickly secure accurate data on sound and noise levels, thereby reducing testing and manufacturing costs. Since accurate readings can be quickly secured, manufacturers can test their production for uniform noise levels. The unit is especially valuable to the design engineer in noise level reduction work.

Th model 300 Sound Level Indicator consists of a calibrated crystal type microphone, an audio frequency amplifier with the new all metal tubes, a calibrated attenuator, an ear weighing network, a decibel meter and a crystal type headset. The range is from thirty to ninety decibels A. S. A. standard for A. C. or D. C. operation.

"....Clear and Unlimited"

Our versatile commentator, in his highly interesting and entertaining manner, makes pertinent remarks concerning doers and doings in aviation.

by SWANEE TAYLOR

SHORTLY before this was written, an Air Corps officer on duty at Mitchell Field, which is situated right there at the rear of Long Island's horsey set, lived up to the best Donald Duck tradition in cantankerousness of that Post.

This time, little Boy Blue blew his horn, rattled his sword and galloped forth to kick a news photographer smack in the stomach, sometimes called belly. And just because the inoffensive photographer was standing around the smouldering wreckage of a great big wunerful army bomber, with his camera open.

The fact that Blue Boy arrived on the scene, some two miles or more from the government reservation, nearly forty-five minutes after the crash doesn't matter here. Nor is it my design to take up cudgels on behalf of the press. Strangely enough, the American press can well take care of itself even in the face of Mitchell Field's nastiest in-grown disposition. It not only can, but in this particular instance most certainly did.

You should have seen how the New York papers went to town about the crash. They made it look like $60,000 of the tax-payers' money had been thrown away very foolishly.

However, the reason I resurrect the incident is to put you on guard against the spirit of Hessianism which has apparently taken root at snobbish Mitchell Field. I think I'm right else there would never have been official condonement of Blue Boy's tantrum, not to say excuses made for him.

Better stay away from that place unless you are veddy veddy social, fresh from the stable or smell like a horse!

Close-In Airports

Oddly enough, the world's two largest cities, London and New York, are alike in the matter of being without centrally located air terminals. (I know I should include Chicago, but I'm not positive that it is the third largest city.) Similarly, in both instances the reason for this is a colossal short-sightedness on the part of the men at the head of their respective governmental agencies.

Our own Mayor LaGuardia splutters unceasingly about turning teenie-weensie Governors Island, in the upper Bay, into a passenger depot and can think of nothing else. While in Merrie England, we hear another official leans heavily against any advancement of an unorthodox sort. I take the N. Y. *Times* for my authority.

According to the astute *Times* the following statement was made by Viscount Swinton of Masham, British Air Minister. The occasion was the dedication of a new airdrome at Gatwick, some forty minutes south of London by rail, and it came when someone asked m'lord what

And behold! Here is a third and the most lifelike of Swanee's portraits that have appeared in these columns.

about a centrally located airport to serve the constantly swelling list of Londoners who use aircraft in their daily comings and goings. To which he replied:

"A certain number of rather unintelligent people ask me, 'When are you going to establish an airport in the middle of London?'

"The answer is when everybody in London has become so air-minded and unaesthetic as to cut down every tree in Hyde Park and turn it into an airdrome."

Evidently the Air Minister is completely out of step with his monarch, alert, up-to-date King Edward VIII. However, I am willing to predict that within another ten years m'Lord, the Viscount, along with the rest of the staid stolid beefsteak bloc on Rotten Row, will have been shouted down by the rude middle clawsses clamoring that a centrally located air depot is more important than a spot of greensward in the heart of a great metropolis. And I won't be at all surprised to hear that pilot King Edward is the one who launches the idea. God save the King!

Pin-Prick

Some members of the New York State Aviation Society may suffer acute deflation when they learn here that the society didn't have a thing to do with killing the proposed Uniform Aeronautic Regulatory Act at the last session in Albany. It was the up-state Utilities Lobby that turned the trick. Public utilities, you know, are agin' moving their transmission lines even at the price of buckets and buckets of human blood.

If I Ran an Airline:
(Still Using Walter Winchell's Matchless Style.)

...I'd paint my ships in vivid colors so they could be seen on murky days. (A silver airplane against a cloud's gray lining is about as discernable as a white rabbit in the snow.)

...No traffic man, or other ticket office personnel, could sneak off with the best magazines when he went out back to powder his nose. (Harried passengers might want to take them out themselves.)

...I'd see to it that POPULAR AVIATION (Adv) was placed in easy reach for the customers on all ships and in all waiting rooms. (No sense handing a red-hot air fan such magazine fare as *The Barber's Monthly Manual, The Plumbers' Friend* or *Babies Just Babies.)*

...A lot of attention would be paid to pilot morale. I'd try to instill a deep pride of performance and lasting company loyalty. They'd all be treated like men, not automatons nor schoolboys, and most all would act like men. The others would soon be driven forth by the bright flame of trustworthiness which vermin can't face for long.

...And, remembering the fate of the erstwhile lordly railroads, no one in my company, from me down or up, would be allowed to get supercilious about private flying. (It's not our air, besides Henry Ford made roughly a billion bucks in thirty-three years out of popular personal transportation.)

Antiquity Answers Back

Not a little amusement—and some complaint—has been aroused by what is called the Antiquarian tenor of last month's *Clear & Unlimited;*—the part acknowledging receipt of my first letter. My correspondents either laugh at me for sitting down at the quaking role of Elder Statesman, else they shame me for a grossly misinterpreted intent to take my ease in Zion from now on and let the younger fellows do all the hard work.

Also, one very keen mind accuses me of high treason for the statement that our generation failed to make the most of the most glorious implement ever placed in the hands of mortal man.

Well, a glance around reveals that the colleagues of an earlier year are, today, perched pretty unanimously on the old waterwagon. Which, in itself, is a good indication that our splendid young bodies are no longer young, despite occasional virile thoughts. Nor will a one of us, hollow laughter notwithstanding, go out for football again.

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XUM

Eight Years to Build a Plane

A PROMINENT business man of Bradford, Pa., recently asked Mr. T. V. Weld, Salesmanager of the Taylor Company, what effort would be required for one person to produce a safe airplane of finished-workmanship, of the lightplane class.

This question was prompted by the business man's son who had progressed from model airplane building to flying and was interested in building an airplane. Summing up the matter, after considerable research, Mr. Weld found that in the first place, the young man would need at least four years of Aeronautical Engineering at a good university.

Second; two years, at least, of mechanical work in airplane factories to become a skilled Airplane Mechanic.

Third; a year would be required to design the plane, analyze stresses and strains and submit a Stress Analysis to the Bureau of Air Commerce.

Fourth; after the listed seven years, the young man, with the aid of 250 machines, using 30 different materials, would be able to manufacture and essemble the 2500 necessary parts in something over 80 full days of labor.

Fifth; the finished airplane, after eight years of effort, would be an experimental airplane and could be licensed as such. At least one year's flying, under many different conditions, would be necessary to determine the reliability of the ship and "get the bugs out" as remedying flaws in design and workmanship are spoken of in aeronautical circles.

And then comes the real rub—the time required for merchandising the plane. Some firms struggle through the first eight years of design and construction but in the end, lack the product that has performance and appeal.

Ryan S-T Holds New Record

PETER DANA, 20-year-old flyer, who holds the light plane west-east transcontinental record, established a new three-flag record from Vancouver, B. C., to Agua Caliente, Old Mexico, with the new Ryan S-T sportplane.

Young Dana, a graduate student of the Ryan School of Aeronautics, San Diego, clipped one hour 13 minutes from the previous mark. He left Vancouver at 4:01 a.m. and after five fuel stops touched the ground at Agua Caliente at 4:35 p.m. His elapsed time mark of 12 hours 34 minutes is contrasted with the 13 hours 47 minutes record of youthful Frank Kurtz, University of California athlete, which Kurtz made last August. Dana's flying time was 11 hours 6 minutes.

T. Claude Ryan, head of the Ryan Aeronautical Company of San Diego which built the plane, and also head of the school where Dana learned to fly, was at the Agua Caliente field when Dana came in for a fast landing at the end of a fast flight. Fuel consumption was only eight gallons per hour for the 1,270-mile trip.

More News from the Flying Flea Headquarters

"Pou Bebe," the latest development in open type Flying Fleas, with Henri Mignet, the designer, sitting in the cockpit.

WE HAVE just received some information concerning the new Flying Flea, now undergoing flight tests in the hands of Henri Mignet, the designer of the Flea.

In the first place, the French Government has taken a tremendous interest in the Flea and has placed the matter in the hands of the Government engineers, who have made extensive investigations as to the aerodynamic qualities of the Flea and their possible improvement. The French engineers have just completed a series of wind tunnel tests to determine the proper relative positions of the front and rear wings, which, to that date, was a matter of dispute and uncertainty.

Not to be outdone by the French laboratories, the English Government is making investigations into the matter at Teddington, and so the matter goes merrily on in Europe.

One of the accompanying photographs shows the last word in Flying Flea construction, a genuine authentic last edition built by Mignet. This open-cockpit job, with Mignet in the cockpit, has undergone several modifications, the most important being the substitution of tubular control struts to the front wings instead of the previous uncertain cable controls. The entire control system now consists of rigid members and the photo shows these struts running from the fuselage to the trailing edge of the wings.

The little open job, now being put into production in France, is provided with a 25-horsepower, two-cylinder, two-cycle engine which gives it a top speed of 100 m.p.h. It weighs about 225 pounds and can takeoff, fly, land and stop within 300 feet. The landing speed has been reduced to 15 m.p.h. A new landing gear has been installed, which does away with the old type rubber shock-absorber cords.

(*Concluded on page* 67)

And, believe it or not, here is a genuine Flying Flea air-sedan designed and built for comfort rather than speed.

The NATIONAL AIR BOARD Says—

Unbiased Opinion to Further National Aeronautics

MEMBERS OF THE BOARD

Richard Aldworth
Douglas Campbell
Benjamin D. Foulois
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D. W. Tomlinson
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Augustus Post
Earl R. Southee
William Van Dusen
R. C. Wood (Paris)

ALEXANDER KLEMIN, Chairman

INVITATIONS to serve on the Air Board have been accepted by a group of distinguished men representative of every phase of American aeronautics. The first informal meeting was held in New York City on June 10th, and a general concept of functions and policy was established.

The Board will meet in monthly conference to discuss freely any and all aspects of the industry that appear of current importance. The sole task of the Board will be to render opinions which shall be unbiased, completely disinterested and calculated solely to advance a common national cause.

There are many splendid aviation organizations already functioning, but they have been created to advance, in perfectly legitimate fashion, the interests of some particular group or groups, and to act accordingly.

The Air Board will not act but deliberate! It will have the functions of an informal court, without power to enforce decision, but with an opportunity to make its findings dispassionate and wise so that they may gain national respect. It is from soundly informed opinion that sound policies originate.

Nor will the courage to voice an unpopular view fail. Sometimes the utterance of an unpleasant truth is an imperative obligation.

Safety in flying will be a particular object of concern. While the investigation of individual accidents is a task for governmental authorities and operators, the Board expects to give attention to such important questions as the desirability of full publicity being given to accident investigations; the improvement of the safety characteristics of planes for private flying; the raising of standards of operation in private flying; necessity of ever improving our aids to navigation; and the desirability of emphasizing safety just as much as technical advancement.

The conferences will deal with national aeronautics not solely with national aviation. The exponents of lighter-than-air are in a small minority and their branch of aerial navigation has suffered many set-backs. It is all the more important that their views, too, and their arguments be carefully and dispassionately considered.

We have been flattered in recent years by the visits of European government officials and aircraft constructors. But it is dangerous to think that American superiority is to be permanent, unless there is continual vigilance and the will to forge ahead. Therefore with the aid of representatives in foreign countries the Board will emphasize for the benefit of our own country, those factors of aeronautics in which European countries show more aggressive leadership.

Thanks to the Guggenheim Medal, the Collier Trophy and our engineering societies, outstanding achievements of a "classical" character are sufficiently well recognized. But there is one all important field namely, the popularization of private flying in which recognition and award are sadly lacking. The Air Board will have at its disposal means for recognizing and rewarding service in this field along with other activities which have hitherto failed of official recognition.

WE welcome this exceptional opportunity of presenting to our readers, as an exclusive monthly feature of this magazine, the reports, deliberations and counsel of The National Air Board.

This is, indeed, a great privilege and a distinguished honor to have the monthly counsel of some of the greatest minds in aviation in solving current problems, that are continually arising in this industry. This Board comprises many of our most brilliant aeronautical engineers and competent executives, as well as many pioneers who have grown up with aviation from its infancy.

Governmental activities, national and state legislation will be commented upon fairly and fearlessly, irrespective of politics or sectional feeling.

One of the outstanding characteristics of mankind is to regard advances and novelties with alarm. Even in a comparatively new branch of applied science such as aeronautics, there is a tendency to frown on radical departures. In the composition of the board there is sufficient guarantee that fantastic inventions and ideas will not be readily entertained. But if rocket flight, glider trains, manpower flight and helicopters, to give typical examples, are sometimes regarded as being in the lunatic fringe, they will be given fair and friendly consideration whenever occasion arises.

With no written constitution, or rigid rules, the policy of the Board will be flexible and its deliberations timely.

It may be of interest to explain briefly the mechanics of the Air Board meetings. Suggestions will come from its individual members in writing. However, those coming from the public at large will not be neglected. Discussion will be free and exhaustive; opinions will be issued as a group responsibility. Where definite majority and minority opinions emerge, they will both be given publication. At times individual members will prefer to issue initialled statements.

POPULAR AVIATION will do its utmost to serve as a medium for the wide circulation, of the opinions expressed. But it is most important to remember that neither the Publisher nor the Editors of POPULAR AVIATION will seek to influence the conferences in any way whatsoever. They merely provide an instrument for the transmission of the views of the Board and express a willingness to serve in this capacity only.

* * *

A NEW YORK TIMES news item states that all Turkish youth of both sexes are to be instructed by Russian teachers as glider pilots (under the auspices of the Turkish Government). Parachute jumping in Russia is organized "en masse". England, Canada subside flying clubs in the purchase of equipment and expenses of instruction. Louis Hirschauer, Inspector General of French Commercial Aviation advocates the public expenditure of 20,000,000 francs to reduce the cost of flight instruction to the small sum of thirty-five dollars.

If the situation in the United States is reviewed, the above heading is apparently justified. *(Board opinion.)*

CAN PASSENGERS BE CATAPAULTED?

Increased speed and payloads have increased wing loadings to figures unbelievable five or six years ago. But wing

loading cannot be increased indefinitely because take-off is bound to suffer. Hence suggestions which come from many quarters, that catapaults should be used in commercial aviation.

The theoretical advantages of catapaulting are indisputable *but* here are common-sense objections:

"Reaction upon passengers is a point to be considered. A passenger would have to be braced just as for a catapault shot." (D. W. T.)

"Do not all the leading makers of engines now allow a short overload for take-off? I am afraid that catapaulting a 20,000 pound plane would be a very difficult job and that the passengers would strenuously object to." (R. C. W.)

WHO BUILDS THE MOST POWERFUL TWIN-ROW?

The Pratt and Whitney Twin-Row Wasp now delivers 1150 horsepower at sea level and we thought that this was the world's most powerful air-cooled engine. But the Paris member of the Air Board writes that Gnome and Le Rhone has just brought out a new 18 cylinder twin-row delivery 1320 take-off horsepower, in spite of moderate compression, light supercharging and r.p.m. of only 2100.

"So you can see that there is a considerable margin there for future development of more power." (R. C. W.)

DEVELOPMENT OF LARGER ENGINES RECOMMENDED

With high octane fuels, air-cooled engines are now developing 1000 horsepower with dimensions no larger than those of the 500 hp. motors of three or four years. The Allison Engineering liquid cooled engine is said to provide an even greater horse-power with a diminutive front area. While these engines are being purchased under the stress of military and naval necessity there is not the slightest doubt that they will sooner or later pass into commercial service.

The Air Board agreed that:

"With traffic on the airlines constantly increasing and with huge flying boats designed for oceanic service, the Army and Navy should pursue the development of still larger and more powerful engines, avoiding the intolerable multiplicity of power units in very large aircraft, and leading to the 2000 hp. unit suitable for both military and commercial use."

A FIRST TOPIC FOR HEATED DISCUSSION

Discussion of the airline accidents of 1936 led to the following pertinent questions:

Should not Air Commerce Bureau concentrate entirely on its functions of regulation and maintenance of aids to navigation?

Is not dissipation of the Bureau's energies on the initiation of the $700 flivver airplanes and other activities which pertain strictly to the industry likely to lead to disastrous weakening of its effectiveness?

Decidedly so held some members of the Board.

But another member took a diametrically opposite point of view:

(*Concluded on page* 56)

Prize Offered for Diesel Invention

The Hemphill Trophy offered for the best Diesel engine invention.

INVENTORS with inclinations toward Diesel engines are given encouragement through a $1,000 cash prize offered for the best Diesel invention submitted during the next twelve months.

A perpetual silver trophy has also been offered on which each year's winner's name will be inscribed. The $1,000 prize and the Diesel Inventors' Trophy will both be given by Mr. Ralph Hemphill, one of the country's strongest advocates for Diesel engines.

It is reported that this contest is the first one ever made in the Diesel field that offered a cash reward. Cash prizes for inventions in other fields are not new, and many of the improvements in present-day gasoline engines were brought out by similar contests that have been conducted during the last fifteen to twenty years in the gasoline engine field. Had it not been for the continual invention of new devices and designs for gasoline engines, the present-day smooth running passenger car engine probably would not have been achieved.

This is an exceptional opportunity for our readers to present their ideas on Diesel engines, particularly on aeronautic Diesels with which many are quite familiar. There is undoubtedly a great future for the Diesel type engine in aviation.

Letters From Our Readers

AND now a contribution from a Canadian friend, Harold Sanders, 18 Hugo Street, Toronto, Canada. He sends us an interesting clipping on a big Canadian transport job which is really a marvelous performance, even in these days of mammoth transport ships.

The biggest single air freighting contract ever let in the world has been made between Argosy Gold Mines and Canadian Airways. Starting immediately after the break-up, Canadian Airways is to handle 500 tons, one million pounds, of miscellaneous freight, largely fuel oil, from Goldpines on Lac Seul to Casummit Lake, the location of Argosy. The distance is 70 miles. Freight will be transported from Hudson to Goldpines by water.

Argosy Mines is now sending in a large tonnage of new mine and mill machinery and supplies needed at once to complete the enlargement of the mill. Although the combined water-air rate is slightly higher than that being charged at present over the tractor route, officials decided to use air freighting to save immediate expenditures on supplies and transportation and take in stuff as needed during the summer.

Canadian Airways proposes to use its Junkers JU-52 as much as possible on this contract, but a lot of it will be carried by ordinary aircraft. The JU-52, the largest single engine plane in the world, is capable of taking freight loads of almost three tons. It has become known in the north as "the flying box car."

We are always glad to get these news flashes from distant points and trust that Mr. Sanders and other Canadian readers will contribute interesting items of this sort.

* * *

AND next we have a suggestion for a safety device by Ted McElroy, Box 21, Cooperton, Okla. If this could be made automatic, it would probably prove a worth while scheme, but it is likely that the pilot, or co-pilot either would have little time in which to prepare this message.

Too many ships crash and no one knows the cause. The cause can be divided into three general groups: Engines, Ships and Weather. Most transports carry a co-pilot so we will give him the job of leaving a record of the cause of the crash before it occurs.

We would provide each ship with three small bombs. A red bomb for engine failure, a green bomb for ship failure and a white bomb for the weather. Each bomb would be equipped with a water tight compartment and a small parachute.

A board with prepared forms, covering all possible causes of trouble and indexed in such a way that the pilot could find the proper form, is inserted in the bomb. To get it overboard quickly, it would be located close to the bomb rack. A colored ribbon could unroll from the bomb as it fell.

It would certainly take a calm composed type of man to prepare this data, and we would suggest that Mr. McElroy enlarge

(*Concluded on page* 60)

Willis Cooper—Our Hangar Ace

Here's a new slant on an interesting hook-up between aviation and radio and the article also introduces an original and entertaining personality.

by MAX KARANT

HE SAW action in France and with the National Guard in Mexico. He's one of radio's top notch writers today, knows more about aviation than many people in the industry itself yet is not a pilot. He wields a mean candid camera and aviation photography is his greatest passion. Unless, perhaps, you would call the writing of horror stories for one of his programs — Lights Out—a passion.

This versatile little man is Willis Cooper of Chicago, California, New York, north, west, south and east—and west by northwest.

Famed and unknown men in aviation alike know Bill Cooper personally. When another of his programs was started recently, he and Jules Herbuveaux, another aviation fanatic who is an official of the National Broadcasting company, named it Flying Time.

At first the industry was apathetic to what they thought would be "just another one of the too-many crazy, impossible aviation yarns". But Cooper and Herbuveaux had other ideas for Flying Time. First, however, let's take a peek at Bill Cooper.

Here's Willis Cooper, his typewriter (mill) and solace in the form of the cigarette held at a rakish angle.

He's squat, plump and thirtyish. Stubby hands that are constantly pounding one of his two typewriters spend their spare time nervously crumbling freshly-lighted cigarettes. He does his best writing whether it be aviation or horror stories in the blackest hours of the early morning when Mrs. Cooper and the two Scottie pups are asleep.

Willis Cooper grew up in Pekin, Illinois, where he was born. His first real job was as a chemist in a pre-war liquor distillery (which may explain Bill's knowledge of the whys and wherefores of present-day liquor).

He had just passed the age limit when the war broke out and a few months later he was helping his infantry outfit throw everything but their old socks at the Germans. The enemy apparently knew Cooper was in the vicinity for they managed to plunk bits of scrap iron in his hide twice. He got two classy wound stripes for that.

When he wasn't sloshing around in the mud of the Somme trenches, Cooper was wheedling airplane rides in the R.E.8s from a nearby outfit, the 40th Australians. But after a few dusk patrols in which the Aussies were far less invisible than they would appear, he decided to do all his flying on the ground. From that time on he developed his ability to "hangar fly" to such an extent that today he is president and charter member No. 1A of Swivel Chair Pilots, Ltd. (I'm vice-president in charge of operations.)

The World War came to a glorious climax for Bill one bright day in July, 1918, when a playful German in a shaky camera plane decided to warm up his machine guns on the tiny French town in which Cooper's outfit was quartered. A British company also was in the town which accounted for the sudden and extreme anger displayed by two Tommies who, disliking Fritz's nerve, opened up with a Lewis machine gun mounted on a posted wagon wheel. Fritz, on the other hand, got mad and dived on the Tommies and pumped them both full of lead.

Cooper's activities in the A. E. F.

That was all that was needed to rouse the Scotch fighting blood in Cooper. Bill, still young and foolish, tore for the Lewis gun. The German must have seen him for he heeled up into a tight vertical bank down in the street about a block. For a fraction of a second, however, Fritzie made a beautiful target and Cooper cut loose.

Even before the gun's smoke had cleared the black-crossed camera plane came down with a demolishing thump almost in the town square. Out of the debris charged an extremely indignant German pilot who apparently was highly insulted at being shot down by so little a fellow as Cooper. And a kiwi at that!

That little episode gave Bill a bigger kick than that a few months later when he watched Eddie Rickenbacker shoot another German camera ship down in flames.

Bill came back from France only to head for Mexico with the National Guard. He's had to insist ever since that it *was* the National Guard he was with and *not* General Pershing. It seems that every soldier who ever saw Mexico was with Pershing. Cooper claims to be the only American soldier who wasn't Black Jack's right hand man in the hunt for Pancho Villa.

From Mexico to Peoria, Illinois, didn't seem to be Cooper's idea of the best change of atmosphere so he headed farther north to Chicago. Here he spent a short while with an advertising agency writing copy.

It was just about that time that sunny California hired some long-winded press agents to ballyhoo their land of "ambrosia and nectar". Bill went, thinking that such things might exist, and found

what every tourist has found before and since. So, he managed to find himself a job.

As things got more and more monotonous, Bill drifted toward the nearby aviation centers which, at that time, were one airport—Clover field—where Art Goebel, Leo Nomis, Bob Lloyd, Ken Montee and Sir Charles Kingsford-Smith all helped Bill with his hangar flying.

In spite of all the colorful flying the Black Cats were doing for the movies in those days, Bill decided to pack up and head back east to Chicago. It was while writing for the Columbia Broadcasting system there that Cooper got the idea for Flying Time. But Columbia, assuring Bill that he was a nice guy and all that, turned him down flat. That may or may not be the reason he switched to the National Broadcasting company. However, NBC did more than just lend him their ears. They put the show on the air as a sustaining program which it is today.

Flying Time, at first frowned upon by the aviation industry, now is accepted with open arms and, along with Lights Out, also a sustaining NBC program, is one of the most popular programs of its type on the air. Cooper takes great pains to see that every detail, however small, is exactly right. Which makes Flying Time the only legitimate aviation show in radio. For instance, it's little technicalities like this that bring Flying Time fan mail from all sections of the country.

The program is kept so close to actual fact that Cooper had the idling, cruising and wide-open sounds of Wasps, Hornets, Wright Whirlwinds and whatnots recorded out at Chicago's municipal airport. So when you hear a Boeing P-26A taking off in a steep zoom over Flying Time some evening at 6 p.m. E.S.T. you can rest assured that the engine you hear is that with which the Boeing is equipped—the Wasp.

Aviation's headliners as well as men taking part in the everyday operation of airlines (pilots, dispatchers and radio men) are interviewed once a week on Flying Time—on Fridays. Whoever the "Friday guest" is, he is written into the continuity and appears as part of the story. In this manner Mr. and Mrs. Joe Doakes hear all about the inside of aviation as it really is, not as some imaginative, uninformed writer thinks it is.

"With Flying Time," Bill told me the other day, "we are trying to counteract the constant fear that accompanies the mere mention of flying. I know and you know that aviation is by far the safest means of high speed transportation known to mankind today. Statistics prove that, but the average person's respect for cold figures is nil plus. So, with Flying Time we hope to drive home the fact that newspapers play up the comparatively rare airline accidents in much the same way they would have played up the story 100 years ago when a snorting demon of the rails ran down Mrs. Zilch's favorite cow."

Day and night, zero-zero of CAVU, you can find Bill Cooper at his type-

(*Concluded on page* 70)

Aviation Training Given in the CCC

by HENRY C. HELBIG, JR.

This is the training ship used in the CCC aviation training camp.

MANY young men who are very much interested in aviation and some who have had previous training have found their way into the Civilian Conservation Corps, which is an organization composed of men between the ages of 18 and 28 years.

It has not been the policy of the government to include in the regular educational-vocational program in the camps, the study of aviation. However, aviation interest and adoption of such studies are being sponsored by the efforts of the educational advisers and individuals in each camp to meet the demands set forth by these young men.

In many camps there are libraries which contain valuable data and interesting information on various phases of aviation. This source has proved to be very beneficial in keeping these individuals in contact with the flying world.

Another prominent source of value is the construction of model aircraft. This has become very popular and has furnished a very successful and interesting source of knowledge to supplement actual mechanical and flight training.

The more fortunate camps have been able to secure obsolete equipment in the form of engines and complete airplanes from the various government departments for ground school uses. Equipment obtained in this manner is not allowed to be used in actual flight, however, an Air Corps officer or other official on CCC duty may voluntarily give actual flight instructions to the men having previous time in the air to their credit.

The many educational institutions in the nearby communities of many camps probably offer the best opportunity for advanced technical training. The evening classes of a number of these institutions have CCC men enrolled in their elementary, mechanical, aeronautical engineering, aviation administration, and numbers of other courses. In several instances CCC men have been able to obtain their college degrees after majoring in and completing their courses in aviation.

Gliding has been used successfully in training in camps located in parts of the country suitable for gliding and soaring.

The organization of aviation clubs has been found to be the most common of methods of value in the promotion of aviation interest among individuals and groups in the camps and also in the surrounding communities.

In Camp Arlington, located just across the historic Potomac River, in Virginia and south of Washington, D. C., the aviation enthusiasts have many excellent opportunities to study and acquire much valuable aviation knowledge.

The curriculum of the Arlington University, the camp school, includes a course in model aircraft construction, a complete technical ground school course, the use of an excellent and extensive aviation library, and the absolute cooperation of the aeronautical institutions in and near Washington to train these men for a career in aviation.

The camp school has been among those that have been very fortunate in obtaining a complete Boeing F-3-B1 airplane, 2 Navy Curtiss D-12 engines and much technical data from the U. S. Government for use in the courses.

The courses are arranged so as to cover a period of six months. Model aircraft construction is studied during the first three months and the complete technical ground school course is included in the last three. Actual flight training is obtained at a nearby airport at very low rates upon completion of the six months' course taught in the camp school.

Practical work on the airplane and motors, lecturers, blackboard illustra-

(*Concluded on page* 66)

A Bear Flew Over the Mountain

Another of Mr. Hopson's entertaining and hilarious "Cow Pasture Yarns" which have appeared from time to time in P. A. The tales hark back to the old barnstorming days when flyers grew feathers.

by WILLIAM L. HOPSON

ONLY Heaven alone knows where the old Breuget originally came from.

I suppose the old battle wagon was built in France, shipped over here for some reason or other and finally found its way into the swarthy hands of the Basque pilot. At any rate, at the moment of flying acquaintance and I drove into the pasture the ancient biplane took off.

It came bellowing down the runaway like a lumbering milk cow, mushed off the ground, stuck its nose in the air—and stalled. For a split second it seemed to hang motionless in the ozone, then pancaked to the ground with the sharp sound of a flat board hitting water. "SPLATTTTT!" just like that.

A man crawled gingerly from the rear cockpit as we came hurrying up. About twenty-three he was, slender, swarthy and handsome, and togged out from head to heels in a new flying outfit. Shiny boots, whipcords, silk scarf and all. He caught sight of my friend, yanked off helmet and goggles, threw them to the ground and then began jumping up and down on them like a spoiled kid whose candy had been taken from him.

"Look at eet!" he howled disgustedly, all the while bouncing up and down like an automatic jack-in-the-box. "Look at eet!" he shouted at my friend. "Three hondred dollars I pay you for six hours eenstructions and what happen? The firs' time I take off for Canada after a load of liquor she crack up!"

And that, gentle reader, was my first meeting with Ramon the Basque pilot, as nutty a bloke as ever flew a ship. Little did I realize that a couple of years later this same dizzy Basque, his mechanic "Mabel" and "Beefsteak," Ramon's overgrown cub bear would give me as many hilarious hours as a man ever experienced.

I never did learn Mabel's real name—though I do know how he got his nickname. It seems that shortly before I hooked up with them, Mabel, who spent most of his time in the pursuit of the fair sex, had fallen hard for a good looking blonde who, unfortunately had a husband. To make a long story short, hubby finally came home unexpectedly—and when the amorous airplane man came back to consciousness he opened one eye and murmured weakly, "Where's Mabel?" and passed out again. the name stuck.

As for poor Beefsteak, Ramon simply came in one day lugging him under one arm and that was that. He'd spent twenty-five dollars of his father's sheep money—and the old boy had *gobs* of it—for the bear as mascot, and for several days afterward had amused himself by playing with it and riding the half grown cub around in his Ox5 Standard.

However, his interest soon had waned and he'd hired the landlady to take care of the animal and feed him plenty of ground up beefsteak all because somebody had told him it was the finest of bear food. And then came *that* afternoon.

I came home to the boarding house to find both Ramon and Mabel about three sheets in the wind and going strong. Fifteen minutes later I had caught up and was going stronger. By this time the room was getting a bit stuffy and, in opening a window, Ramon happened to catch sight of Beefsteak taking his afternoon snooze down under the old shed where we kept him tied.

"Ha!" ejaculated the Basque Eagle,

Here's Beefsteak and his dizzy pilot.

squinting uncertainly. "There's m' little bare. C'm on, fellows, letsh take heem f'r a walk."

Well, we piled downstairs into the backyard and untied the rudely awakened Beefsteak, who, a bit nonplussed at the sudden attention showered upon him by his long negligent master, backed off and eyed us suspiciously. A few minutes later the three of us were heading up the street with the resisting Beefsteak bringing up the rear—or rather sliding along on his rear.

Now, when we had left the house, Mabel wanted to go see his girl (a single one this time), Ramon wanted to go to town, I wanted to go out and fly and Beefsteak, judging from his actions, didn't want to go anywhere. So we compromised and headed for a certain home whose owner had the reputation, among certain people, of making the finest beer in town.

"Holy Saints!" groaned the sweating Ramon a few minutes and two blocks later, stopping to eye the still resisting Beefsteak. "I don' like thees bare no more. All the time he cost me money an' w'n I take heem f'r walk all he wanna do ees scooch on hees pants. I'm gonna turn heem loose."

Unfastening the chain from the snap in the cub's collar he raised up and, with exaggerated carefulness, drew back his boot for a shot at the rear part of Beefsteak's anatomy. Unfortunately for him Beefsteak was too fast and he missed by inches. When we picked the disgruntled Basque up off his back his late pet was already ambling across someone's well kept lawn.

Then hell broke loose the next morning. In quick succession Ramon paid for damage to several trees, for one deceased tom-cat which had been the pride and joy of an irate housewife, a ruined washing hung on the line and, worst of all, a large garden.

"He's up in a tree in my front yard now," wailed the feminine owner of the garden over the telephone to our landlady. "You tell that crazy aviator to come right over here and get him down."

But wanting the recalcitrant Beefsteak down and getting him down were two entirely different matters. His round belly filled with the choicest of what the garden had to offer, he sat comfortably ensconced in the fork of a tree and refused to budge an inch, even though Mabel bounced rocks off his head until Mabel's arm hurt. We finally tied the chain around the bole and left him, knowing he'd come down again when he got hungry.

Ramon made one more unsuccessful attempt to get rid of the cub that morning. In a body we called on the city fathers, whose pride was a small zoo out in the city park. He generously offered him to the city which already had two other bears, but since these two happened to be girl bears and Beefsteak was a boy bear, his offer was gently but firmly refused.

It was Mabel who finally discovered a solution. About a hundred miles distance over the mountains was a larger town which undoubtedly would have a bigger zoo and more room for Beefsteak. "Why not let's fly him over?" he suggested.

So we went out to the field. While the motor was warming up Mabel crawled in the front cockpit and I boosted Beefsteak in on top of him. Ramon put on his helmet and crawled in. A few minutes later they took off.

Now, strangely enough, Beefsteak apparently had forgotten his former flying

(*Continued on page 64*)

Cooperation Necessary in Rocketry

If rocketry is to prove an immediate success in the United States, there must be a closer connection between the various units now operating independently. Mr. McNash points out how better results can be obtained by concerted effort.

by C. W. McNASH, President,
American Institute for Rocket Research

THE question is frequently asked as to why it is that Rocketry has developed so slowly since the fundamental principles are so sound and wide-proven.

There are two great obstacles in the path of Rocketry in America. These are namely: (1) The lack of cooperation and coordination between the workers in the field and (2) The lack of funds to permit experimentation on a large scale, the various organizations in the country struggling along on pitifully inadequate sums of money.

With the realization of the great potentialities of the science and with a clear vision of the obstacles confronting it, the American Institute for Rocket Research, made possible by the cooperation of POPULAR AVIATION, has been formed.

We believe that there is enough knowledge concerning the Rocket Motor and Ship available in this country at the present time to permit the construction of successful liquid-fuel Rockets. The purposes of the A. I. R. R. are as follows:

1: To coordinate the efforts of the various workers in the field and aid them in every possible way to attain their common goal of high speed transportation in the stratosphere by means of Rocket Motors.

2: To obtain funds and backing, if possible, and to bring all the Rocket experts in the country together in a sort of convention, and to formulate, by consultation, plans for a great attempt which, because of the combined strength of resources and intellects, should lead to a world-acclaimed success.

A rocket plane takes off the ice without a catapult at Greenwood Lake, N. Y., the first rocket airplane flight in history.

3: To provide favorable publicity for all those engaged in Rocket research.

Considering the handicaps under which they have labored, the experimenters in the field have accomplished surprising success.

For instance, the Cleveland Rocket Society, under the leadership of Ernst Loebell, Cleveland, and the American Rocket Society of New York, both sustained only by small membership fees and dues have done much valuable work on the proving stand, a device used in testing the rocket motors without releasing a rocket. Operating temperatures, pressures and the driving power of the motor are thus determined without the added expense of an actual rocket "shot."

Considerably more fortunate are the circumstances under which Dr. Robert Goddard, a veteran Rocketeer, works. Some years ago, in 1929, the Guggenheim School of Aeronautics was sufficiently impressed to provide Dr. Goddard with a proving field at Roswell, New Mexico, and funds to continue his work.

Under these rather favorable conditions Dr. Goddard has pursued his experiments, and his tests on the liquid-fuel rocket motor have added tremendous impetus to the cause of Rocketry. In fact, it was Dr. Goddard who showed American scientists that the Rocket ship was not a wild figment of the imagination, but a tremendously rapid medium of transportation.

On one of his experiments Dr. Goddard accomplishd a speed of about 700 miles per hour with a twelve foot Rocket weighing 140 pounds. As far as is known, this is the world's record for speed, although the Germans hold the record for altitude, about six miles. Goddard's successes are the result of almost thirty years of patient effort.

Among recent attempts, the ones attracting the most attention were the Ley-Kessler experiments at Greenwood Lake, New Jersey. The outstanding feature of these flights lay in the design of the ships, which were more in the

(*Concluded on page* 58)

The load of mail for the rocket flight is packed in asbestos bags ready for the first rocket-mail flight at Greenwood Lake, N. Y.

A 1936 Fairchild "45" Appears

Many refinements have been incorporated in the 1936 edition of the Fairchild "45" which add much to the attractiveness and comfort of this popular model.

THE 1936 model of the Fairchild 45 five-place low-wing monoplane differs in a number of outstanding points from the model announced in September of 1935. The new plane is powered with a Wright R-760-E-2 radial aircooled engine of 320 horsepower instead of the Jacobs 225, making possible a cruising speed of 173 m.p.h. with 220 horsepower at 5250 feet, a top speed of 180 m.p.h. with 320 horsepower at sea-level, and a landing speed of 49 m.p.h. with the flaps down. The plane has a service ceiling of 18,000 ft. and an absolute ceiling of 20,000 feet.

Two front seats—each 17 inches wide and separated by a 6-inch aisle—have replaced the single wide seat in the 1935 model. The rear seat is 50 inches wide and 18 inches deep. Back of the rear seat is a shelf, in which there is a door giving access to the main baggage compartment during flight. The movable windows actuated by a crank of the automobile type are located in the front part of the cabin.

A single door on the right side is provided in the 1936 model in place of doors on both sides. The instruments have been regrouped so that the flight instruments are centered. A nut-cracker type undercarriage replaces the splined oleo type previously used. The dimensions are the same.

The cantilever wing is built in three sections with an N.A.C.A. 2218 section at the root, tapering to an N.A.C.A. 2209 section at the tips. It has an angle of incidence of 2-degrees with dihedral of 6-degrees beyond the center section and has a 15-degree sweepback.

In the center section is a compartment for 46 pounds of baggage and two 60-gallon gasoline tanks. The center section houses the landing-gear when retracted.

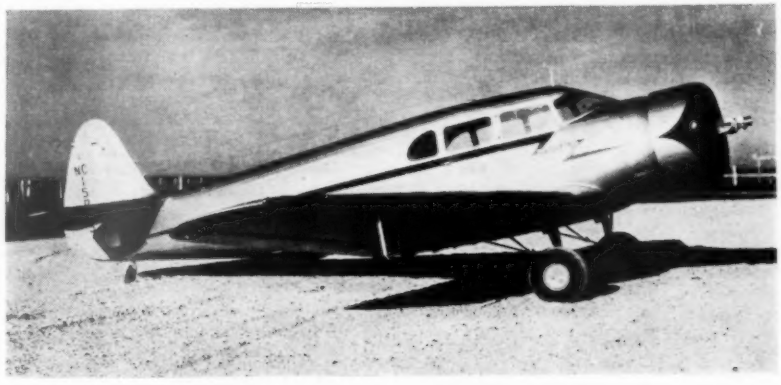
There are three flaps extending along the trailing edge in three sections from aileron to aileron. They are constructed of aluminum alloy tubing and metal ribs and are aerodynamically balanced. The flaps are operated by a hand lever for instant raising or lowering. A gliding ratio of about 3-1 is claimed for the airplane with the flaps lowered. The ailerons are air-foil sections, tapered and balanced.

The 1936 Model "45" Fairchild in flight with the landing wheels in their retracted position. The cruising speed with standard equipment is 173 m.p.h.

The tail surfaces are cantilever design with true air-foil sections. They are built up of aluminum alloy ribs and steel torque tubing and are fabric covered. The stabilizer and elevators are located on the top line of the fuselage. There is an adjustable tab on the rudder to correct yawing tendencies during speeds above or below cruising speed.

The "dep" control column has been retained, and the wheel can be "thrown-over" for operation from either front seat. The landing-gear is retracted and extended electrically and there is an emergency handcrank on the left side of the cockpit for manual operation. A crank operates the adjustable trimming tabs on the elevators and a knob control operates the rudder trimming tab. A klaxon horn and red light operate in conjunction with the landing-gear mechanism; a new type gear box indicator has been installed.

Special attention has been paid the arrangement and appointments of the cabin so that it resembles the interior of a luxurious streamlined automobile sedan. There is unusual leg-room. The seats are deep, wide, and comfortable. Hot or cold air is admitted to the cabin by means of a duct on the side of the fuselage. Switching from hot to cold air is done by means of a valve. The amount of cold or warm air is controlled by shutters which may be operated from either the front or rear seats.



The 1936 Model of the Fairchild "45" powered with a Wright R-760-E-2 engine of 320 horsepower. This plane is a five-place low-wing monoplane with a retractable landing-gear.

SPECIFICATIONS

Length	30 ft. 4 in.
Span	39 ft. 6 in.
Height (overall)	8 ft.
Front Seats	17 in. wide
Aisle between seats	6 in.
Rear Seat	50 in.
Empty (with standard equipment)	2474 lbs.
Gross load	4000 lbs.
One pilot	170 lbs.
Four passengers	680 lbs.
Baggage & Accessories (with 90 gal.)	91 lbs.
Baggage & Accessories (with 60 gal.)	271 lbs.
Fuel 90 gallons	540 lbs.
Oil	45 lbs.
Total normal useful load	1526 lbs.
Total payload (90 gallons)	771 lbs.
Total payload (60 gallons)	951 lbs.
Wing loading	16.1 lbs.
Power loading	12.5 lbs.

PERFORMANCE

With 4000 lbs. gross weight—controllable pitch propeller (all figures guar-

(*Concluded on page* 54)

"Flying Grandfather" Receives Pilot's License

PAUL P. LYONS, 62-year old Civil Engineer, Bradford, Pa., received his Private Pilot's License from the U. S. Bureau of Air Commerce, of the Department of Commerce. For some time, Mr. Lyons has held the rare distinction of being one of the world's "Flying Grandfathers."

Several years ago, Mr. Lyons embraced flying as a hobby and today he declares that flying is his favorite pastime. Two years ago, he secured his Amateur Pilot's License and at present he has 75 solo flying hours to his credit.

Last fall, Mr. Lyons took up a Taylor "Cub," two-place sportplane, as a sporting proposition to find out just how far the little plane would glide without a motor. Over Salamanca, N. Y., at an altitude of 12,500 feet, he shut off his motor. From this point, he calmly glided the 21 miles into Bradford and landed safely on the Bradford Airport.

A short time ago, Mr. Lyons took his test for a Private Pilot's License before Inspector Russell A. Young, of the Bureau of Air Commerce, at the Bradford Airport.

This test has the same flight requirements as the test for the Transport Pilot's rating. Mr. Lyons was required to demonstrate his ability to recover from tail spins, make spot landings and maneuvers, as well as vertical banks and figure eights. With little difficulty Mr. Lyons passed this test in the same reliable Taylor "Cub" in which he glided from Salamanca, N. Y., to Bradford, Pa.

Pyroil Company Issues a Report

A REPORT on the beneficiation of lubricating oils in their application to cadmium-silver, copper-lead and babbitt metals, issued by Pyroil Company, LaCrosse, Wisconsin, is now available, on request to Pyroil Company.

This report contains highly interesting charts and 6 pp. photomicrograph. By means of photomicrographic reproductions, various degrees of chemical and mechanical attack on different metals, and the control of the same are indicated under varying load and temperature conditions.

The Texas Centennial Model Meet

ONE of the outstanding model airplane meets of the year will be the Centennial Model Airplane Contest to be held at Dallas, Texas, on July 29. Everyone can enter by sending for the application blanks. Address Golden Aircrafts Corporation, 1013 Elm Street, Dallas, Texas.

All sorts and description of aircraft models can enter the contest under a number of different classifications such as the Endurance, Stick model, Flying scale model or Freak model divisions. The meet will be governed by the rules of the National Aeronautic Association.

It should be particularly noted that to participate in a sanctioned N. A. A. contest that it is necessary to be a member of the Junior N. A. A.

Huge Airplane Factory Buildings Under Way

This is the huge steel frame of the new Douglas assembly plant. Note the tremedous clear span of the roof trusses and the knee-type columns.

ERECTION of the sixth and final bay of the largest single arch structure built this century has been recently completed for the Douglas Aircraft Company, Santa Monica, California. The structure, which will be used for final assembly work, will soon be ready for occupancy.

With a clear span of 250 feet, the new Douglas structure is exceeded in its single arch dimensions only by a mammoth train shed which was erected in Pittsburgh before the turn of the century, according to H. H. Wetzel, General Manager of the Douglas Aircraft Company.

Many unusual details feature this new Douglas unit. Incorporated in the arched roof construction is a saw tooth window design that admits the maximum of light. In addition, two walls of the building and the entire sliding door arrangement adjoining the airport are glazed. The unobstructed height from floor to rafters is 30 feet.

The new building has a floor space of 85,500 square feet. This area, taken together with two other new units that have a combined area of 285,000 square feet, will more than double the size of the present factory and make it by far the largest manufacturing unit of its kind in the world.

Construction of a large and modern assembly unit costing more than $250,000 was begun in May by the Boeing Aircraft Company of Seattle on a 28-acre tract recently purchased adjacent to Boeing Field.

Sufficiently large to accommodate nine fully assembled Boeing 299 four-engined bombers, the new structure will be 204 feet wide, 304 feet long and 53 feet high, with an interior unobstructed floor space measuring 200 by 300 feet and with interior overhead clearance of 35 feet. In addition, there will be a one-story power house, 35 by 50 feet, which will house a heating plant, transformers and compressor equipment.

The main building will have walls of insulated metal sheathing, a saw-tooth type roof to provide adequate interior lighting, four rows of windows extending the length and breadth of the build-

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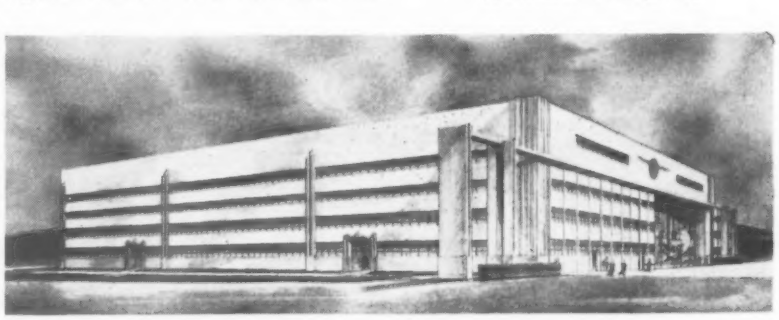


This enormous building, shown by the architect's drawing, is sufficiently large for assembling nine "299" type Boeing bombers. It has a clear floor space 200x300 feet.

2-Row Engines for Transports

The design of engines for large commercial transports has arrived at the turning point because of the heavier duty now imposed upon the engines. In this article, the author gives an interesting and instructive account of the 2-row radial engine applied to commercial lines.

by CHARLES W. DEEDS
Vice-President United Aircraft Corp.

SINCE the ascendency, in the early 1920's, of the radial aircooled type of power unit both for military and commercial aircraft we have watched the requirements for power increase to the point where we are taxing our normal nine-cylinder radial engine beyond points of safe and economical operation.

Previously, in response to urgent demands on the part of the aircraft operator and manufacturer we have been able to step up engine power through the addition of internal supercharging, by increasing compression ratios, by judiciously strengthening parts, by permitting higher r.p.m.'s, and by using gasoline with high octane rating. The resultant power increase was and is dependable.

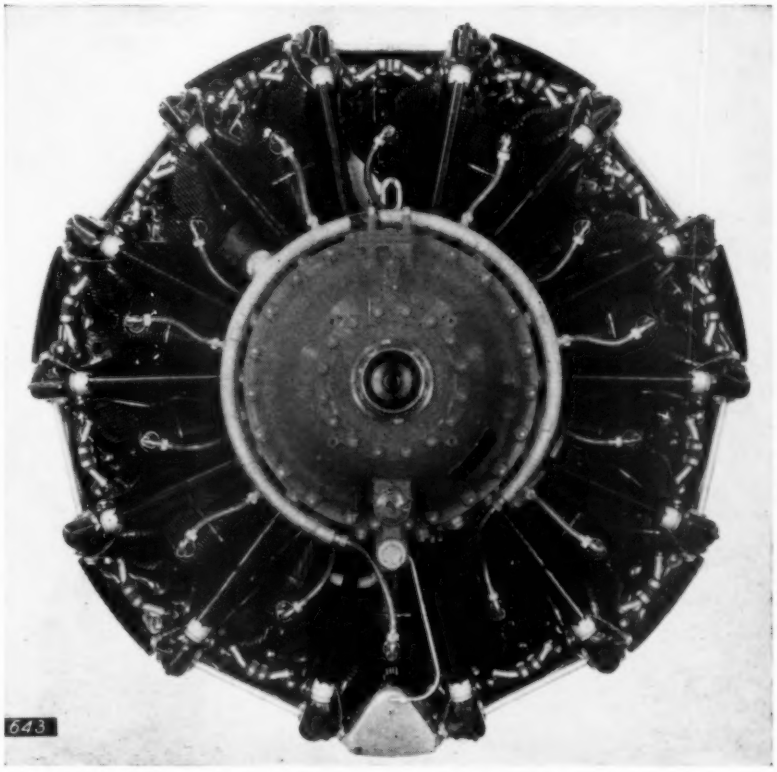
But there is a definite limit to this type of power squeezing, a limit beyond which further development is not sensible, nor safe nor economical. We have reached that limit, in some cases we have exceeded it, and where it has been exceeded the results have been far from satisfactory and surely not in the interests of the dependable flying necessary to increase the value of our commercial transport system and make effective our newest means of national defense.

The answer to the situation as it exists today is relatively simple. Theoretically, by putting two single-row engines of proved quality together, we have a power unit of much higher performance—the two-row engine, and through its development and perfection high horsepower requirements may be met.

Seven years ago our Pratt & Whitney Aircraft Division began to experiment with the two-row design to supplement the single-row. Its work on this project and the subsequent perfection of two engines, one with 1535 cubic inch displacement—the Twin Wasp Jr., and the other with a displacement of 1830 cubic inches—the Twin Wasp, serves as an outstanding example of the rapid progress which has been made in this vitally important field.

Work started on the development of the first Pratt & Whitney two-row type in 1929 and has been progressing quietly since that time with the result that now more than 500 of these engines have been delivered and placed in service. The type can be considered the last word in power plants proven at horsepowers well in excess of those being currently produced by any other aircraft engine in this country.

Prior to 1929, it was becoming evident that the limit of power from nine cylinders was fast approaching. Pratt &



The Pratt & Whitney Twin-Wasp, the largest model of which is rated at 900 horsepower with 1,000 horsepower available for take-off.

Whitney believed, and still does, that a normal rating of 750 h.p. with an allowable over power for takeoff in the neighborhood of 800 to 850 is about the maximum that can be expected from a nine cylinder single-row engine with safety and satisfactory performance and maintenance.

The advantages of multi-cylinder power plants are even greater for aircraft than for automobiles, where there is ample evidence of the replacement of the four and six cylinder engines with six and eight cylinder engines respectively. The smaller, more frequent power impulses provide smoother operation and longer life. When you consider that in the Pratt & Whitney Twin Wasp there are 250 light impulses per second from a 5½-inch cylinder at cruising horsepower and in the highest powered nine cylinder single row engine there are 130 heavy explosions per second from a 6¼ inch cylinder, the advantage in smooth power flow is quite obvious. The use of smaller cylinders in itself permits greater crankspeed further contributing to the smoothness of operation.

The combination of high crankspeeds with comparatively small cylinders permits a greater mean effective pressure with any given fuel. Therefore more power for a given displacement can be obtained. This of course, means higher power for takeoff, emergency operation and for regular cruising.

The largest model of twin-row engine now in current production, the Twin Wasp, is officially rated as a result of official test by the Army Air Corps, at 90 h.p. with 1000 h.p. available for takeoff. However, if this engine is opened full throttle at sea level, it will give 1150 h.p. for a weight of 1250 pounds. In case of emergencies, the value of this reserve horsepower is obvious and in past operations serious accidents have been avoided by making use of it.

Each new engine model is submitted to a gruelling overload test before the actual service rating of the engine is determined. For example, our rigid policy requires that every engine model

pass a block test of 100 hours at takeoff horsepower before the rating is permitted. The normal requirements for approval of a takeoff rating call for only ten hours of operation at takeoff power.

Distinctive and exclusive features of the Twin Wasp and Twin Wasp Junior include completely automatic valve gear lubrication, automatic mixture control, the very latest in cylinder head finning which, together with patented pressure baffles, give maximum cooling and minimum fuel consumption. The valve lubrication is absolutely complete and automatic.

It circulates continuously engine oil under pressure through the valve mechanism, requiring no action whatever on the part of the pilot or ground crew and unfailingly insures positive and equal lubrication of all parts. As a result of this basically correct design it has been possible to extend the time between valve checks from the former period of 20 hours to a minimum of 80 hours and in some operations as much as 100 hours.

The Pratt & Whitney patented automatic mixture control gives positive control of fuel mixture ratio and power output for three operating conditions under the control of the pilot. The control is set for takeoff allowing full throttle and full rich mixture.

Immediately after takeoff, it can be set for climbing at rated power with a moderately rich mixture. When the cruising altitude is reached the control is switched to cruising position which limits the power to a predetermined amount required for cruising and the fuel consumption to an economical minimum.

From this point until the completion of the flight no further attention of the pilot is required regardless of changes in altitude. With the advent of the Hamilton Standard constant speed propellers the conventional method of setting the mixture control by the r.p.m. is no longer possible. This device therefore becomes an essential and outstanding feature as an aid to efficient operation and as a means of relieving the pilot of a burdensome duty.

The cylinder-head design consists of cast on rocker boxes and deep, closely spaced cooling fins. This feature is essential to efficient cooling and, when coupled with the deep, closely spaced fins and pressure baffles, makes possible the high power output and low fuel consumption of the two-row engines.

The pressure baffles developed and patented by Pratt & Whitney are ingenious deflectors between the cylinders which entirely blank off the free flow of air over the engine, directing it between the fins so that all air which is passed over the engine is efficiently utilized for maximum cooling.

The principle is based on the pressure built up at the front of the engine by the propeller and by the forward speed of the airplane with a lower pressure created behind the engine by the venturi effect of the cowl, resulting in draw-

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They Call Them "Air-Girls" in Japan

TOKYO KOKU KAISHA, the Tokyo Air Transport Company, Japan, engaged in passenger and mail service from Tokyo to Shimoda, has employed beautiful young stewardesses on their passenger runs. As evidence of this fact, they send us the accompanying photo.

The stewardesses—they call them "air-girls" over there, have many tasks of a varied nature. They handle the tickets, assist the passengers during the flight—pointing out places of interest—and supply their guests with the necessary information concerning airlines and air-taxies.

The really charming young girls shown in the photo, are Miss Yoko Onoda (left), 20 years old, and Miss Yoshie Kato, 18 years of age. We believe that they are just one more reason why travelers become air-minded in Nippon.

And, also being air-minded, we are curious to know the make and model number of the trimotor behind the air-girls. This would also be of interest to our readers, particularly if it were a Japanese built plane. This type is unknown in the United States and we crave information on the subject.

When you air-tour Japan, you may meet up with Miss Yoko Onoda (left) and Miss Yoshie Kato, "air-girls" with the Tokyo Air Transport Company, Japan.

Stunting With Gates Air Circus
by JOSEPH R. JAMES

TOWARDS the middle of September of 1927, we had played such towns as Port Jervis, Newburgh, Poughkeepsie, Kingston, and those upper New York farming communities that still thought a safe parachute jump was an Act of God. We were gradually working our way to the fatter and bigger gate receipts of Albany and Troy.

So it was in Troy one early morning after a very successful week-end at the Cohoes-Ford airport, that Roy Ahearn and Lee Mason finally caught up with the outfit. Lee's habit was to remain a day or two after the Circus had left to "mop up the remains", as he termed it, or to carry those passengers whom we could not accommodate during our stay.

Roy Ahearn, however, was the mystery man of the outfit. He was always two or three days or sometimes even longer, catching up with us because of a crack-up or various arguments with his motor. It was a mystery how he ever did catch up with us as he did, but he always found us just about when we were ready to give him up.

This gay Indian summer morning Roy was especially ambitious and his pep was enough to wilt the flags blowing over the airport. His roving, curious eyes soon came to rest upon a small Gates Flying Circus flag, bravely matching the young pilot's enthusiasm and flying mildly in the soft breeze, right above our army supply tent pitched alongside the field. Stubbornly he challenged, his eyes flashing with excitement.

"I'll bet you five bucks, Joe, you can't take that flag off in three attempts."

I glanced at the flag, lazily dug out a five-spot, shrugged, and handed it to Lee Mason, standing beside us. There was nothing more exciting to do, so what the hell? "Lay down your money, optimist," I murmured, not realizing that the screwiest kind of a wager had been offered and accepted as mildly as accepting another offering of strawberry short-cake.

The little flag was perched not more than two feet above the main pole of the regulation army squad tent. To hit this heavy pole with any part of the ship would have meant a bad crack-up, perhaps a fatal accident. Realizing fully the seriousness of my task, I circled carefully into position and made my first dive for the flag.

As I pulled up and glanced backward I saw the flag was still there; I had missed cleanly. I circled again and dived down, much closer now, but still I missed it by a few inches only. In the middle of my second dive, however, I caught a fleeting glimpse of a blurred figure that somehow looked like Pangborn, dash out of the tent and hold two outstretched fists above his head, waving them at the sky.

Later on, I found it was "Diavalo" Krantz, and I didn't have to hear what

(*Continued on page* 68)

Instruments for Blind-Flying

This authentic article, by a veteran pilot with experience in all branches of aviation, gives a clear and accurate description of the instruments used by airliners when the vision of the pilot is obscured.

by JOSEPH R. JAMES (T-56)
Instrument and radio beam instructor, United Air Services

BY covering up the eyes of birds and turning them loose it was discovered that they could not stay in the air and would fall "out of control," helplessly beating their wings, having lost all sense of balance and direction with the loss of vision.

If birds can't fly blind, then how can man do it? How is it possible for a modern airliner to take off in fog and proceed towards its destination in the face of weather when the birds refuse to leave the ground more than a few feet? The pilot "goes on instruments."

A concentrated group of such flying instruments, taken on one of the modern airliners in flight at night, is shown by the accompanying photo. A brief description of each instrument and what it tells the pilot will give the reader a fair idea of what is meant by instrument flying.

The top instrument is an eight-day clock showing only four figures for simplicity. Time is a very important element in flying since every trip is figured on time and speed basis.

Directly below it is the Sperry Gyroscopic Horizon. This instrument, when set in operation by air suction, indicates the exact altitude of the plane in relation to the horizon.

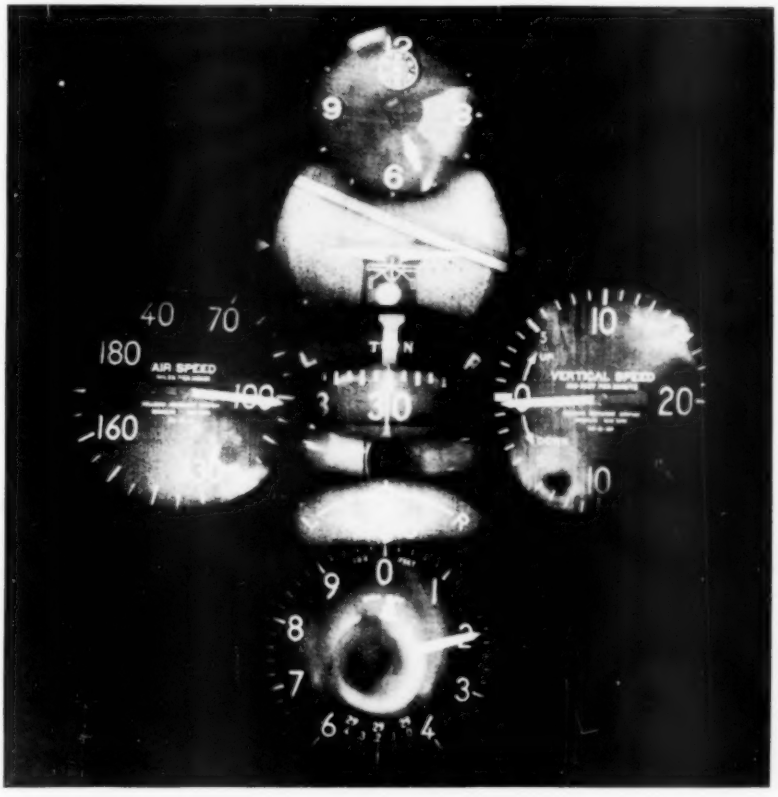
Unfortunately, this instrument was not in operation when this picture was taken. If it had been, the diagonal white line representing the horizon would be horizontal, the nose of the ship on the line and the wings parallel to it. This would indicate to the pilot that his ship was in a level attitude.

Directly below the Sperry Gyroscopic Horizon will be noticed a "compass rose," with 30 in the center. This instrument is known as a "Gyroscopic compass" and is always checked and reset at frequent intervals to coincide with a magnetic master compass, which is not shown on this picture.

If the number 30 remains stationary, it tells the pilot that he is flying 30° East of North. If this drum with its little numbers moves, the ship is turning. Below the black mercury ball you will notice an arc with the letters "L" and "R" at either end of it and the word "Radio" underneath. This is the radio compass, one of the latest developments for navigation of aircraft.

As long as the plane points its nose directly towards the station located on the airport, for which the plane is heading, the needle in the middle of this instrument will be centered in a vertical position. Should the plane begin to turn, the needle of this instrument will lean to "L" or "R", depending on the direction of the turn.

The last and lowest instrument is the altimeter, indicating the altitude. Since this instrument operates on the difference in air pressure above the sea-level, it cannot always be depended upon, especially on long cross-country trips where mountains and different weather conditions are encountered. It is the "weak sister" of the entire group and has been responsible for many air disasters in the past. Unfortunately, so far, we have no reliable instrument indicating accurately the plane's altitude from the ground below.



Here is a group of the instruments used in blind-flying by which the pilot can navigate the ship in fog or in the clouds.

This vertical group of instruments, aided by the radio compass and the altimeter, is known as the "Sperry Gyroscopic group of flight instruments."

Now let us glance from left to right and take up the instruments shown in a horizontal plane in this picture. On the extreme left you will notice an instrument known as an "air speed indicator." In this particular case the hand of this instrument points to 100, meaning that the plane is traveling through the air at an *air speed* of 100 mph. This does not necessarily mean 100 mph. ground speed; it may be more or less, depending whether the wind is on the nose or tail of the plane.

If 100 mph. is the normal cruising speed of this plane then, as long as the needle remains at 100, everything is as it should be. If the pilot should unconsciously pull the stick gently back, the plane would climb, slow up its speed, the hand going down successively to 90-80-70 and if the climb is increased, will reach its stalling speed and start settling perhaps out of control. If the ship is nosed down, the hand will likewise go up, showing a dangerous increase in speed.

The instrument in the center with a vertical hand and the letters "L" and "R" on either side of it and directly below, the black mercury ball which is free to slide to the left and right, and is the key instrument of all blind flying and is known as the "Bank and Turn" indicator. If the plane turns, the central hand leans over to the left or right indicating the magnitude and direction of such turn.

In order for a plane to make a proper turn, the plane must be properly banked. The pilot is making a correctly banked turn if the mercury ball remains in the center and if such a turn is exe-

cuted in a fog, the passengers will be unaware of the fact that a turn has been made. They will be as comfortable as if the ship were flying straight and level.

If, however, the pilot is making a right turn and the mercury ball is off center to the right, he has overbanked the plane and it is losing altitude in a side-slip. If the ball should go to the left of the center in the same kind of a turn, the pilot is turning with too much rudder, not enough bank and is skidding through the air. Loss of speed and discomfort to the passengers is the result.

The instrument on the extreme right is known as a "Rate of Climb" indicator. Each graduation indicates 100 feet of climb or descent per minute. This horizontal group of instruments is known as the "Pioneer" group and is the more dependable and accurate of the two. Both the vertical "Gyro" group and the horizontal "Pioneer" group are independent of each other and are used to check each other. Should any one of the instruments "go out" in flight, the other group would supplement it and the plane would proceed on its course undisturbed.

It is unfortunate that a great majority of the so-called transport pilots (I am not referring to the airline pilots for they are required to know instrument flying) today are not familiar with the modern flight instruments or have a vague idea of how they operate. True enough, it is expensive to equip a plane with such modern instruments and considerable practice is required under the hood with a safety pilot in the front seat of the plane.

The U. S. Army Air Corps instructors, in the year of 1933, realized that there was something wrong with their pilots: they would invariably get themselves in trouble and take to their 'chutes when caught in a fog. It was then realized that it was impossible for any pilot to maintain normal flight when in clouds or fog. Instrument flying was taken up by pilots in all seriousness.

Such training was hampered by the lack of properly equipped planes and weather conditions. A new development, known as the "Link" instrument trainer was brought out, making it possible to go through all the flight maneuvers while sitting on the ground in a warm classroom. It is even possible to fly the radio beams, solve orientation problems, cross-country flights and locate airports while flying by instruments and radio without ever getting off the ground.

An attachment to the Link trainer, known as the "crab," accurately graphs the student's maneuvers and path of flight on the instructor's desk. The student has an actual picture of everything that transpired while he was under the hood.

Since it is not necessary to fly back to start the problem all over again, more than half the time and expense is saved in obtaining this training. All the instructor has to do is to pick up the "crab" and set it down where he desires it and the student can go on with his problem.

A Fairchild "Skyscraper" Aerial Camera

The Fairchild camera for taking obliques of buildings.

BECAUSE the skyscrapers of a large city make it difficult to obtain correct aerial views, the Fairchild Aerial Camera Corporation have constructed a special "sky-scraper camera" that eliminates the distortion that has previously ruined views with common cameras.

This new special camera is from three to four times as long as the average aerial camera and has a focal length of 24 inches. The magazine holds 75 feet of film, sufficient for 110 photographs, each 7x9 inches. This permits the camera man to fly twice as high as he did, formerly, and yet get even more detail. The great focal length avoids the "leaning effect" on the buildings and exaggerated vertical perspective over cities.

An Answer to Lightplane Storage Problems

A BRAND NEW low-priced airplane hangar has been put on the market that should interest all of our lightplane owners and glider addicts.

In the first place it does not cost much if any more than a flimsy home-made hangar. In the second place, it can be financed by the Federal Housing Administration so that it can be purchased at a monthly rate of $9.59 monthly for a period of three years, and that is something to consider in these days.

And then, it has other possibilities than housing amateur lightplanes. It can be used by airport operators to increase their storage space when the customers start kicking about overcrowded main hangars.

And while the price is low, the dimensions are quite large. It measures 40x26 feet, with a width of 12 feet for the tail.

And here's the new Bennett portable hangar in all of its glory. This should appeal to the lightplane enthusiasts.

A New Instrument Landing Aid

After a long period of experimental work, United Air Lines have developed a new landing system by which airliners can be landed without human control.

EXPERIMENTS with a newly developed airplane instrument landing system in which transports are landed without their human pilots touching the control wheels were made public by United Air Lines, whose communications engineers have been working on the project for over four years.

Highly successful results have been obtained in actual tests at the Oakland municipal airport, where the experimental installation of the radio instrument landing system is located.

Guided down a track of radio signals by an automatic pilot, planes have been brought to smooth landings on the Oakland field repeatedly with United Air Lines' double-track radio landing system which is the first commercially to make use of the automatic pilot. Big twin-engined planes have been landed 250 times in tests with contact being made with the ground so perfectly that observers on the planes were unable definitely to tell when the wheels touched the ground.

"The development of a practicable instrument landing system for airplanes has been an important project in United's engineering development program," Mr. Patterson, president of United Air Lines, stated. "While results with our experimental installation have been highly gratifying, we will continue perfecting this system to a maximum of efficiency before making commercial application. It will be several years before we apply it to our regular operation. We are, however, looking to the future when this system will be a definite part of air line operation. Furthermore, the training which our pilots are now receiving in the experimental practice flights is helpful in contributing to their technique of flying."

United's system consists of special radio beams. One is a directional beam sent out by a special transmitter operating on 232 kilocycles. This is the runway marker beam which is narrow, being only five feet wide at the landing circle at the middle of the Oakland airport and only ten feet in width at the boundary of the field.

The second signal is the landing beam sent out from a transmitter operating on 93,000 kilocycles. This is a curved beam following the normal gliding path of a transport plane. The beam is transmitted along the runway, gradually curving upward until it is sixty feet above the ground at the border of the field.

A special antenna is used on the nose of the transport for reception of these signals. On the instrument panel of the plane is a special device which has two needles, one vertical and one horizontal, operated by electrical impulses from the directional and landing beam stations.

Nose view of a United Air Lines plane showing the special antenna used for the reception of two special directive radio beams used for landing. LEFT TO RIGHT: Harry Huking, pilot; R. T. Freng, pilot and J. H. Woodward, United's Project Engineer.

The vertical needle registers the location of the plane with respect to the runway marker beam, while the horizontal indicator records the position with respect to the curved landing beam.

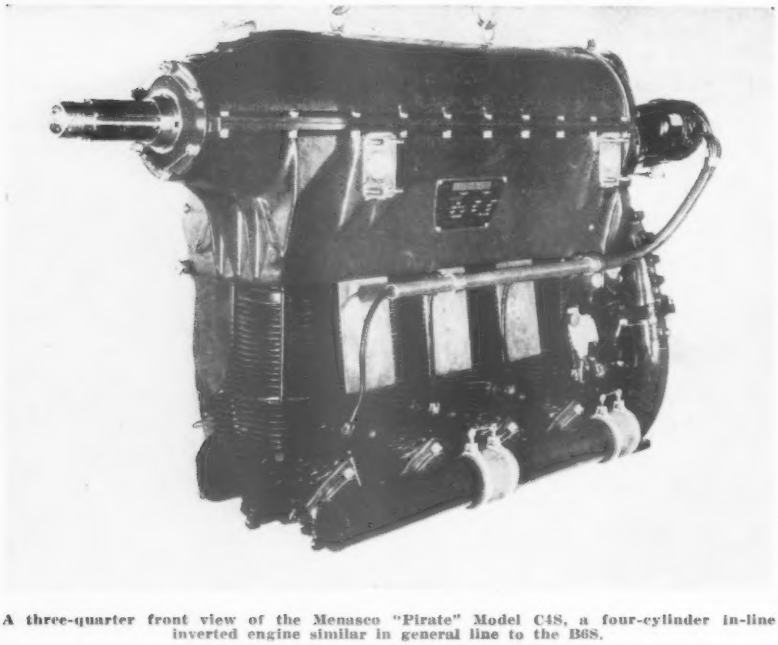
The procedure followed by United Air Lines is for the pilot preparing for an automatic landing to intercept the landing and runway beams at an elevation of approximately 1,000 feet at a distance five miles from the Oakland airport. Maneuvering the plane so that the horizontal and vertical pointers indicate the airliner is exactly on the landing and runway beams, the pilot throttles the plane down to a speed of approximately 80 miles per hour and then turns control of the plane over to the automatic pilot.

He now takes his hands and feet off the controls and concentrates on the instrument with the two pointers. Occasionally he adjusts a knob on the automatic pilot control should the two needles indicate the plane is deviating from the exact landing path.

Except for that, the plane is controlled entirely by the robot pilot. Following the curved beam, which gradually flattens out as it approaches the runway, the plane comes down and makes a two-point landing with tail up.

While instrument landing systems are not new, the novel feature of United's system is the combination of the radio landing with the automatic pilot. Human pilots apparently have a tendency to over-control in making instrument landings, while the automatic pilot insures precision landings by maintaining horizontal equilibrium at all times and also by keeping the plane traveling in a straight line on the ground until a full stop is made.

New Menasco Supercharged Models



A three-quarter front view of the Menasco "Pirate" Model C4S, a four-cylinder in-line inverted engine similar in general line to the B6S.

SINCE Menasco is well known as a pioneer in the construction of the inverted in-line type engine, much interest attaches to the commercial production of the two new Menasco supercharged engines known respectively as the "PIRATE," a four-cylinder Model C4S of 150 h.p. rating, and the "BUCCANEER," a six-cylinder Model B6S engine of 200 h.p. rating.

It has been more than six years since the first Menasco inverted in-line engine, the "PIRATE," Model A4, was granted A.T.C. No. 30, after several years of preliminary development.

In the six years which have intervened, six additional Approved Type Certificates have been granted on new models of Menasco engines. In each case the approvals have been granted on the first application, the result of long months or years of preliminary preparation before the engine was offered commercially.

The Models B4 and C4 four-cylinder engines of 95 and 125 horsepower, respectively, have been widely used in such airplanes as Waco, Fairchild, Ryan and others, and were selected during 1935 by the U. S. Department of Commerce to power their two outstanding lightplane projects, the Waterman "Arrow" plane and the Hammond Model "Y."

The American air racing championship for 1934 was awarded to Lee Miles for his outstanding race flying with the "Miles & Atwood Special" powered with a Menasco Model C4S "PIRATE" engine. For 1935 the award was made to Harold Neumann who distinguished himself by winning the Greve Trophy Race for 550 cubic inch displacement aircraft at the National Air Races with his Menasco B6S powered Howard racer "Mike."

It is notable that both of these engines were of standard commercial type with practically no special features to increase performance for racing purposes other than that they were operated at higher than recommended commercial R.P.M.

The Model B6S "BUCCANEER" has distinguished itself, prior to its commercial introduction, by its record in Europe where it was selected by the Polish team for the 1934 around Europe "Challenge Tourisme Race." The Menasco powered Polish P.Z.L. monoplane that finished first in the 1934 event was widely acclaimed throughout Europe.

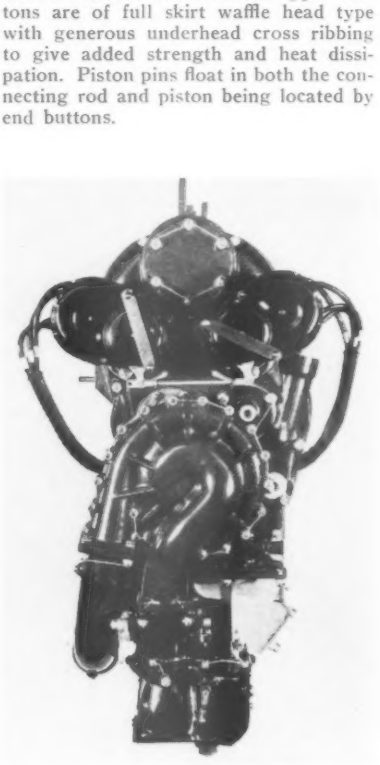
The "PIRATE" C4S and "BUCCANEER" B6S engines have also been widely flight tested throughout the United States in such commercial type airplanes as the Allan Lockheed "Alcor" twin engined monoplane which was built in two types mounting successively the C4 and the B6S engines, and the "Crusader" monoplane which is powered with two Menasco "PIRATE" C4S engines and which has flown and been demonstrated throughout the country.

As with former Menasco engines, the "PIRATE" C4S and "BUCCANEER" B6S models have seen a number of years of intensive development and flight testing. The C4S holds A.T.C. No. 134, granted November 27, 1934, and the B6S holds A.T.C. No. 139, granted December 26, 1934.

These engines are also the lowest horsepower engines of supercharged type available in America. By bringing supercharged performance into the small horsepower field the supercharged Menasco engine has made available to the private aircraft operator the same operational advantages which are enjoyed by the large transport companies. First, the ability to obtain performance at high altitudes and, second, to increase efficiency of operation in cross country trips and add a substantial safety factor in surmounting mountain ranges or circumventing storm areas.

Basic features of the new C4S and B6S engines are similar to other Menasco models which have preceded them. All accessories, including the supercharger, have been grouped at the rear of the engine in such a manner as to be readily accessible. Crankcases are generously ribbed for maximum strength, while the crankshaft itself is carried on five main bearings in the four-cylinder engine and seven with the six-cylinder engine with a ball thrust bearing in either case to locate the shaft against thrust.

All main and connecting rod bearings are of standard babbitt metal type. Pistons are of full skirt waffle head type with generous underhead cross ribbing to give added strength and heat dissipation. Piston pins float in both the connecting rod and piston being located by end buttons.



Rear view of the Menasco "Pirate".

Now in Regular Production

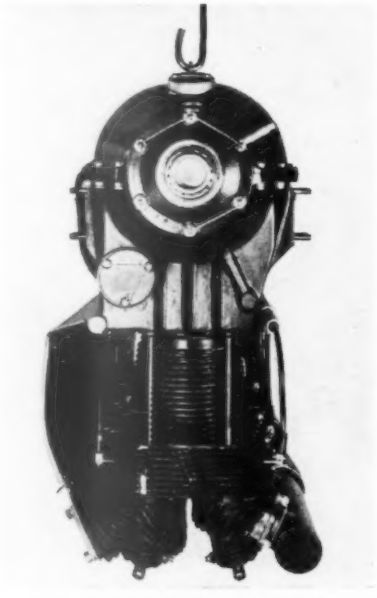
Nickel iron cylinders are standard on both engines, although steel cylinders are optional for lighter weight. Separable heads are held to the cylinder and through to the crankcase by long nickel steel studs which provide easy servicing as any cylinder head may be detached by removing four nuts and disconnecting the intake manifold.

The heads are of Menasco cast aluminum alloy with one intake and one exhaust valve per head spread laterally to provide ample cooling area over the head itself, and with generous finning for efficient cooling. The crankshaft itself has a splined propeller hub end No. 10 S.A.E. type.

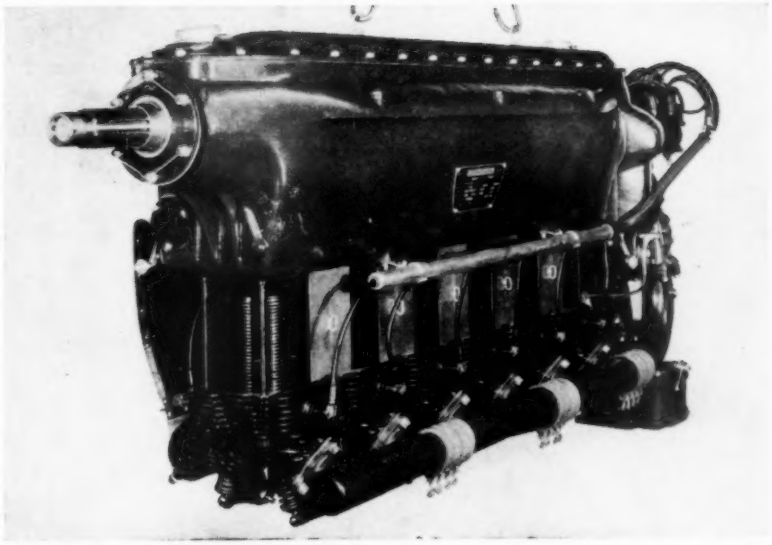
Standard S.A.E. mounting flanges are incorporated in the accessory case for mounting both generator and starter. Magneto ignition is standard with battery ignition optional.

All aluminum castings throughout the engine are of Menasco foundry production, and a wealth of foundry research has gone into the perfection of improved alloys and casting methods which have resulted in superior castings throughout. Superchargers are of Menasco design and manufacture, and both engines incorporate a special type cushion in the supercharger gear train which permits of direct drive without provision of a slip clutch.

Although the construction of crankcases is similar for both engines, the four-cylinder crankcase is split on the center line of the crankshaft and major stresses are carried through the lower case, the upper case serving as a cover.



Front view of the Menasco "Pirate".



A three-quarter front view of the Menasco "Buccaneer", Model B6S, a six-cylinder in-line inverted engine shown ready for installation.

SPECIFICATIONS

TYPE	MENASCO "PIRATE" MODEL C4S	MENASCO "BUCCANEER" MODEL B6S
	4 cylinder, air cooled, in-line inverted	6 cylinder, air cooled, in-line, inverted
A.T.C.	No. 134	No. 139
Bore	4¾ in.	4½ in.
Stroke	5⅛ in.	5⅛ in.
Displacement	363 cu. in.	489 cu. in.
Compression Ratio	5.5 to 1	5.5 to 1
Supercharger Ratio	9.6 to 1	8.75 to 1
H. P. (Dept. of Commerce rating)	150 @ 3000 ft. @ 2260 r.p.m.	200 @ 4500 ft. @ 2250 r.p.m.
Ignition	2 Robert Bosch, Edison-Splitdorf, or Scintilla Magnetos	2 Robert Bosch Magnetos
Carburetion	1 NA-R5 Stromberg	1 NA-R7 Stromberg
Fuel Consumption	.56 lb./H.P. Hr.	.56 lb./H.P. Hr.
Oil Consumption	.010 lb./H.P. Hr.	.018 lb./H.P. Hr.
Dry Weight (without air scoop, fuel pump or propeller hub)	305 lbs.	415 lbs.
Weight of Fuel Pump	2½ lbs.	2½ lbs.
Weight of Side Air Scoop	3½ lbs.	5 lbs.
Weight of hub for wooden propeller	8 lbs.	8 lbs.
Average weight of Wooden propeller	22 lbs.	28 lbs.
Average Weight of Metal propeller	42 lbs.	48 lbs.
Weight of engine crated for shipment	460 lbs.	683 lbs.
Crankshaft propeller hub end	No. 10 S.A.E. Spline	No. 10 S.A.E. Spline
Size of Shipping crate	24.6 cu. ft. 23½x33½x54 cu. in.	32½ cu. ft. 25x40x70 in.
Equipment furnished with engine	Side Air Scoop Lifting Eye Bolts Tool Kit Steel Exhaust Flanges Instruction Manual Propeller hub cones and nut Mounting Supports	Side Air Scoop Lifting Eye Bolts Tool Kit Steel Exhaust Flanges Instruction Manual Propeller hub cones and nut
Extra Equipment furnished on order	Electric or hand starter Fuel Pump Hub for wooden propeller Battery Ignition Electric Generator Special Mounting Supports	Electric or hand starter Fuel Pump Hub for wooden propeller Battery Ignition Electric Generator

Lincoln Beachey—King of Pilots

This old photo, dated 1913, brings back memories of the most daring, capable and most popular of all stunt pilots, past or present. He was a "natural" who flew with an ease and grace never witnessed before nor after.

Lincoln Beachey, early stunt pilot, seated in his Curtiss Tripod pusher. Back of him is the grand-daddy of the "OX" tribe of Curtiss engines. A Gnome rotary engine was later substituted for the liquid cooler.

TWENTY-FIVE years ago, really an age in aviation but not so long ago in the minds of the old-timers, Lincoln Beachey began electrifying the public with his daring flights. And they really were daring, in view of the equipment he used.

Lincoln Beachey, crowned king of flyers, began his aeronautical career as a pilot of balloons and dirigibles and with Baldwin dirigibles won many of the early contests. But the balloons and dirigibles were too tame, peaceable and flabby for the daring spirit of Beachey who dropped the lighter-than-air division as soon as Glenn Curtiss produced a usable plane.

For the old-timers in aviation, the accompanying picture speaks for itself and awakens fond memories. For the benefit of the later generation of air-fans it must be explained that Beachey was the premier flyer of all time, the first to zoom, whip-stall and spiral. And he was the first American pilot to fly upside-down and "loop-the-loop."

He was both a showman and a performer. He was student of effects and of crowd psychology. He could both perform and present his performance so that it would have the desired effect. He possessed an almost superhuman accuracy in the control of his plane, diving at automobiles, buildings and trees, missing them by split inches.

He flew for miles up and down Chicago boulevards with his front wheel a few inches above the tops of the automobiles. He flew through buildings, took off and landed in buildings and performed other miracles where judgment of distance and speed were the principal factors. We shall never again see his equal as an exhibition flyer who could draw the unwavering attention of his audience from the beginning to the end of the flight.

Beachey, in an earlier model Curtiss, flying over the Pacific.

Designing the Landing-Gear

Lightplane designers will be interested in the following contribution by Mr. Gibbons for it deals with a subject that has, heretofore, received but little attention.

by HAROLD GIBBONS

DESIGNERS up until the past two or three years have not given any more attention to the landing-gear than to build it sufficiently strong for a particular plane and have ignored such factors as drag, elimination of excessive weight, etc.

In the last three years designers have realized the value of a light landing-gear and the better performance obtained by using a "clean" type of chassis. Extensive research has caused more attention to be given the landing-gear and results of this research developed the mono-strut gear as well as other various types, the retractable landing-gear being the most noted.

Certainly, then, much attention should be given to the design of the landing-gear of a lightplane. Of course, such features as a retractable chassis and other complicated structures are not to be found in most lightplanes for various reasons which will be related later.

In building the landing-gear for a lightplane, it is well to keep in mind such points as sufficient strength and ruggedness, excellent shock-absorbing qualities, as low a minimum of weight as possible and last but not least, low drag.

Figure 1 shows how to determine how far forward the wheels must be ahead of the center of gravity in order to prevent nosing over. It is customary to have this angle 15 degrees but the minimum and maximum ranges from 12 to 20 degrees.

Obviously, in a plane where the c.g. is low, a smaller angle may be used. On the other hand, if the c.g. is high, or if wheel brakes are used, the angle will have to be high. Naturally, as small an angle as possible should be used since the smaller angle permits of a shorter chassis, consequently there will be less parasite drag offered.

Having decided on this angle, we can next determine the proper angle at which the plane sits when in the three-point landing condition. (See Fig. 2.)

When determining this angle the wings must be set so as to afford at least 95 percent. of their max. C_L. Some miniature planes having a short fuselage are set to give 100 percent. efficiency when in the three-point condition.

For example: taking a wing-section with a maximum C_L of 1.15, the wing must be in such an attitude as to deliver 95 percent. of this or, in other words, be set at the angle where the C_L is about 1.1. In this case the angle would be 14.1 degrees.

Then, if the wings were set at a positive angle of incidence of 1-degree relative to the thrust line, then the angle made by the plane and ground line as in Fig. 2 would be (14.1°—1°) or 13.1-degrees. If the wings were set at a negative angle of 1-degree (where the leading edge of the wing is down) then the angle would be (14.1° plus 1°) or 15.1-degrees.

As low an angle is desired as possible but the proper propeller clearance must be allowed for in accordance with the Department of Commerce, the minimum allowed being 9-inches. The usual clearance of 10-inches is recommended for lightplanes.

There is one other point which must be considered in order to prevent ground-loops and other likely accidents that result from an incorrect angle. (See Fig. 3.) The minimum for this angle is 25-degrees although modern practice dictates a larger angle, say 30-degrees. In no case should the overall tread be more than one-quarter the total fuselage length unless the plane is of a radical design.

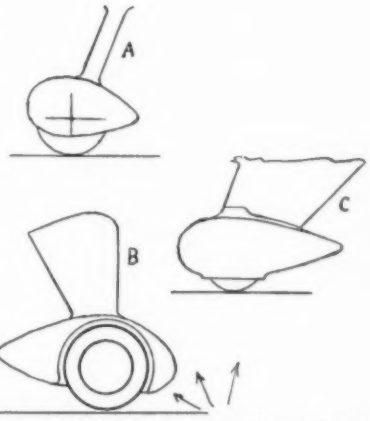


Fig. 5. Three types of mono-struts now in use.

Aeronautics Bulletin No. 7-A states, "Propellers shall have a minimum ground clearance of 9-inches when the airplane is in a horizontal position with the chassis deflected as it would be under the normal gross weight of the airplane. Propellers on seaplanes shall clear the water by at least 18-inches when the seaplane is at rest. A clearance of at least 1-inch shall be provided between the tips of propellers and the fuselage or any other part of the structure.

"Also, that the height of free drop,

Fig. 2. Angle made by the plane when in the three-point landing position.

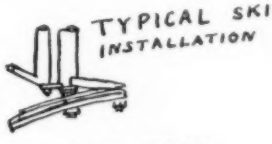
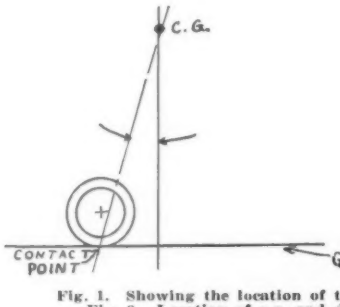


Fig. 6. Tail skid.



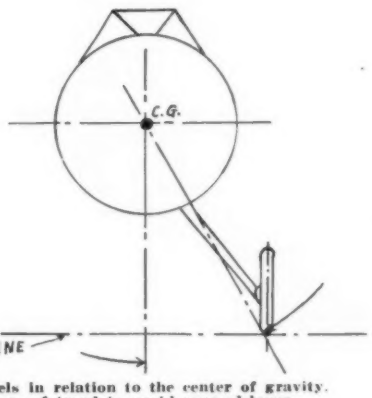


Fig. 1. Showing the location of the wheels in relation to the center of gravity.
Fig. 3. Location of c.g. and dimensions of trend to avoid ground-loops.

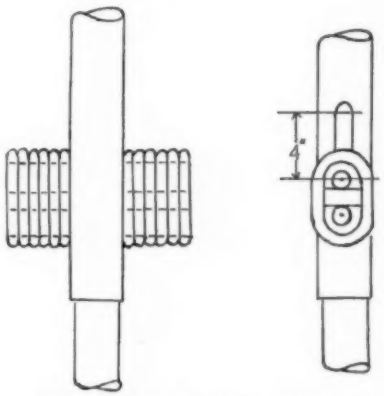


Fig. 4. Typical shock-cord arrangement.

in inches, shall be 0.36 times the calculated stalling speed in miles per hour, except that it need not be greater than 18-inches for conventional airplanes. When high-lift devices or "air brakes" are employed, the height of free drop shall be no less than 18-inches."

Many companies are now using oleo and oleo-pneumatic shock-absorbers in the planes which they manufacture but because of the cost, they are usually out of reach of most amateurs. The simplest way of absorbing the landing shock is by the use of an elastic or spring absorber. The usual travel of an absorber is between 4 and 6-inches although a travel of 8 to 10-inches is more desirable except on the smaller planes. Fig. 4 shows a typical cord shock-absorber.

In the past the landing-gear constituted about 35 percent. of the total drag of the plane. With newer types of wheels (streamline) this percentage of the total drag has been greatly reduced. The wheels offer the greater part of the total landing-gear resistance.

For wheels with the usual fairing the drag for each wheel at 100 m.p.h. is approximately 5 lbs. The so-called "streamline" wheel in which case the fairing extends from the hub to the edge of the tire offers about 58 percent. of the drag of the usual faired wheel. Doughnut wheels have about 12 to 15 percent. of the drag of the wheels that they replace.

Wheels without any fairing offer as much as 70 percent. more drag than the usual faired wheel in some cases. The coefficient of drag for fully faired or streamline wheels may be taken as 0.23 and as 0.43 for wheels with the usual fairing. Wheels with no fairing have a coefficient of about 0.70. The coefficients are absolute units.

The drag of the struts may be calculated as an ordinary streamline strut except for interference between struts and fuselages and wheels which must be allowed for. Drag of strut per ft. $= k \times$ Dia. in in. $\times V^2$ (ft. per sec.). Although a little more difficult to analyze and construct, a mono-strut chassis with either streamline wheels or "pants," or both, should be used. Fig. 5 shows the three types of mono-strut chassis now in general use. Strut (C) of this type is the best for several reasons.

First, the shock absorbing system is entirely enclosed within the covering which eliminates all drag from that source; no dirt, grit, etc., will be likely to enter into the mechanism thereby causing undue wear and preventing the absorber from functioning freely; the smooth skin covering reduces the drag to a considerable amount.

The wire-braced unfaired wheel type of chassis is the worst possible form in every way and should never be used if the best possible performance is to be had. In many cases this has often been the source of trouble that led the amateur to believe that his plane was underpowered.

On one of the recently designed lightplanes wind-tunnel tests showed that the

(*Concluded on page* 71)

Two French Lightplanes of Recent Date

The Sfan-4 pusher is a unique type among lightplanes.

UNDER THE stimulus of the Flying Flea, French amateur activities and lightplane construction have advanced by leaps and bounds. Accompanying this brief note are two of the latest lightplanes, both of which are well worthy of our best attention. First is the radically different Sfan-4 and second is the hot little low-wing monoplane called the Hemipter.

First off, we have the Sfan-4, a pusher type with the engine located above and to the rear of the parasol type wing. As the direct result of this arrangement, the pilot has an unusually great visual range that extends down, up and all around. This arrangement certainly has its possibilities, even though the passenger in the rear enclosure may be cabined and confined.

This plane is driven by a Mangin Poinsard engine rated at 35-horsepower which is a small engine for the performance claimed for the plane. It is said that the speed, fully loaded, works out at about 105 m.p.h. and that the climb is in the neighborhood of 550 feet per minute. The flying cost is only $3.50 per hour, very cheap when we consider that gasoline is bringing about 45 cents per gallon in France.

The Hemipter is a small ship built along big ship lines, a single-place low-wing job powered with a 40-horsepower Salmson engine. As you will note, it is provided with double vertical fins and rudders, a la Lockheed "Electra."

A smooth keen looking low-wing job is the Hemipter.

The Cessna C-34 Four-Place Cabin

(See front cover)

THIS latest Cessna four-place cabin job, powered with a Warner 145 h.p. Super-Scarab is a full cantilever high-wing type, has a fully loaded, sea-level speed of 162 m.p.h. and a climbing rate of 1,000 feet per minute.

The sea-level cruising speed is 143 m.p.h. which is exceptionally high for the given top and power. The empty weight is 1,300 pounds and the gross weight is 2,220 pounds. A duration of four hours at cruising speed is attained with 35-gallons of gasoline. This works out at less than ½-cent per person per mile.

The wings are built on continuous spruce spars with the tips and leading edge covered with plywood. The remainder of the wing is fabric covered. A conventional type of fabric covered steel fuselage is well faired into the wings so that a minimum of air resistance is experienced.

The cabin is accessible through a wide door on each side and the seats are spaced to allow ample leg room. As will be seen from the front cover drawing, the visibility in a downward direction is excellent.

Air Transports of the Future

An interesting analysis of transport airplane design, its past, present and evident future by a nationally known aeronautical engineer and designer.

by ROBERT MINSHALL
Engineer, Boeing Airplane Co.

HAS transport airplane design reached a point where major refinememnts still can be made and therefrom obtain a cleaner and more efficient airplane? The question is debatable.

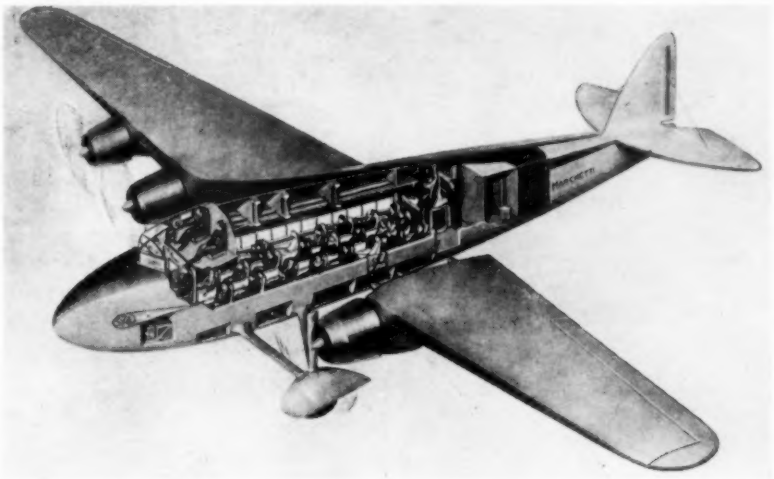
To the average layman, looking at the latest low-wing, twin-engined transports now in use on American transport lines, it would appear that little could be done to increase the airplane's efficiency.

The process of development leading to transport planes such as are now in use on the country's airways, has been a series of steps, each with a definite object in view. These have been fundamentally: a wing with very efficient power plant locations, a body in which to carry cargo and passengers and an empennage of full cantilever construction.

It is true that many cantilever wings have been used in the past, but it required the advent of the ring-cowl on air-cooled engines to give the highly efficient power plant and wing combinations now being employed. Retractable landing gears were suggested as early as 1876, even before heavier-than-air machines ever flew, simply because it was realized that the landing gear added considerable drag in flight.

However, the retractable gears were not universally used until the low-wing cantilever airplane made its appearance and provided an excellent place in which the retracted landing gear might be housed. Cantilever tail-surfaces were used in the past but did not give the desired results until the elevator flap trimming control was developed, eliminating the adjustable stabilizer and its inherent faults due to play in the adjustment mechanism.

Anyone can take a pencil and sketch beautiful pictures of possible airplane types which might be constructed, but this is a small part, indeed, in the process of a plane's conception. It is the hundreds of seemingly small details that make an airplane a success.



A section taken through the Savoia S-74 transport plane showing the interior arrangements.

In past years, it was only natural that airplane designers dreamed of "flying wings" and of such airplanes as are used today, but many details about which little was known, made it imperative that the structural form of the plane be a biplane with wire bracing. Airline operators did not have the landing fields now available and it appeared that planes had had a low wing-loading in order to land on fields as they then existed. Powerplants were not as reliable and forced landings were more numerous.

A few years ago, emergency fields were but natural open spaces devoid of shrubbery and fences. And another point of major importance: there were many unanswered questions of structural analysis regarding cantilever wings and tail surfaces which were avoided by using wire braced biplanes and empennages where the designer knew there was sufficient redundancy to take care of the many unknown factors of air loading distribution.

While discussing this subject, one must give the metallurgist due credit for the development of alloy steels and high strength aluminium alloys. Due to the uniformity now found throughout these materials, especially in connection with heat treatment possibilities, it is practicable to design more efficient structures than were originally possible with wood, particularly with regard to cantilever wings.

A few years ago if an airplane designer was discussing airplane design before a group, he always expected and generally was asked, "Which is the better—monoplane or biplane?" He would assume an evasive attitude and say, "Monoplanes are fine in certain places and biplanes are all right in other places." Today, it is evident that for commercial transport lines, the monoplane will rule supreme. One might, of course, still give the same evasive answer regarding military planes because of the maneuverability requirements of military tactics but that issue will be avoided in this article.

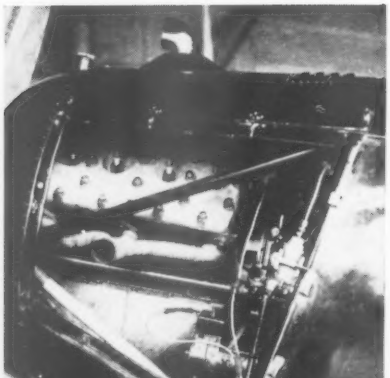
There are, without question, thousands of reasons why the airplane designer's dream of a few years ago of all-metal smooth-skin monoplane transports did not take tangible form until today, but it is enough to say that it now is a reality. But what shall be done to improve it and what is to follow? So far, the general overall efficiency of the airplane

(*Continued on page 66*)

A section through the Savoia S-73 with seating arrangements differing from the S-74.

XUM

Department of Commerce Approves Flivver Plane



TOP. The Ford V-8 powered Arrow plane in flight above Detroit, Mich. LEFT. Engineers examining the Ford engine and indicating the new head. RIGHT. A closeup of the V-8 engine with its Bohnallte cylinder heads. This is the first plane to receive an A.T.C. with a standard automobile engine.

ONE more laurel rests on the bright aluminum brow of the Ford V-8 engine as the Arrow Aircraft and Motors Corporation of Lincoln, Nebraska, received its Approved Type Certificate for its new plane incorporating the standard Ford engine. This is the first airplane to receive its A.T.C. using a standard automobile engine, interchangeable in every way with that used in a car.

David E. Anderson, Chief Engineer of the Bohn Aluminum and Brass Corporation, whose company supplies many parts for the engine, including the Bohnalite cylinder heads, bearings, etc., points out the versatility of this power plant which is not only found in so many automobiles but which also won the World's 225-Class powerboat championship at Toronto last summer and now rounds out its triumphs with this signal success in the air.

Tests of the Arrow plane were recently held in Detroit and were watched with interest by Ford officials. The Ford Motor Company is not connected with the manufacture of the plane but was interested in the aeronautic use made of the V-8 engine.

It was brought to Detroit by Mark Woods, President of the Arrow Aircraft and Motors Corporation, his son Pace Woods and Pilot Jimmy Hurtz, who put it through all kinds of stunts to demonstrate its foolproof design. The plane rights itself from any position and is a marvel of stability.

It uses regular automobile gasoline, climbs at 500 feet a minute, has an absolute ceiling of 14,000 feet and has a range of 350 miles on 20 gallons of gasoline. Top speed is 100 miles an hour and it cruises at 90. Landing speed is 45 miles an hour. It will sell for less money than all but a few automobiles.

This plane and its engine are of more than passing interest because of the economies made in upkeep and operation. Repair parts and replacements can be had at only a fraction of the cost of equivalent airplane engine parts and the ability to use standard automobile gasoline greatly reduces the cost of operation.

Cloud Meteorology
by J. H. BONDURANT

AIRLINE pilots are necessarily required to exercise their knowledge of practical meteorology to the best advantage. Very often much benefit has been derived by considering some of the well known principles of physics which apply to meteorology.

A close study of two of these principles was recently undertaken in the course of routine flying duties with the Delta Air Lines, an airline carrying passengers and mail in the Southeast. The results have been useful and interesting and may prove helpful to the private pilot also. Cumulus and Strato-Cumulus clouds whose bases are less than five thousand feet and which begin to form early in the day, have been frequently observed to check closely with simple deductions made from surface readings of temperature and dew-point and with the most previous pilot balloon observations.

It is well known that air rising by convection or otherwise cools by expansion and if it continues to rise the moisture present will condense as clouds, mostly of the cumulus type. Also, when there are two air masses having different densities or velocities or both, wave motion with attendant expansion and condensation occurs and clouds of the stratocumulus form often develop. With this in mind, therefore actual flight comparisons were made to correlate if possible these phenomena with meteorological observations determined on the ground and by means of pilot balloons.

About seven times out of ten the check with cumulus clouds showed that when the arithmetic difference between the actual temperature and dew-point on the ground was divided by 3¼, the resulting figures gave the height of the base of the cumulus clouds in thousands of feet. The times when this did not check the change in temperature with altitude was markedly greater, the clouds were much lower, the air very rough, and showers or occasionally a thunderstorm developed later in the day. The pilot then, seeing cumulus forming early and at altitudes near 2 to 3 thousand feet knows his trip will be rough and possibly difficult.

The relation with strato-cumulus clouds had an even more important significance. Almost invariably when the pilot balloon observation of the early morning showed abrupt changes in direction or velocity, or both, the clouds of the strato-cumulus type formed later in the morning, the height of these clouds was checked to be very close to the observed changes recorded by the pilot balloon observations. The air beneath the clouds was rough and cold, and the wind velocity frequently high. The air immediately above the clouds was smooth and warm with most often very light velocities.

A check of pressure differences between the air above and beneath the clouds seemed to indicate an increase in pressure at the higher level, a factor to further consider in view of more efficient engine performance.

The Effect of the Slipstream

Mr. Hoffman points out interesting and important facts regarding the effect of the propeller slipstream on the wings of an airplane and the resulting effect of this reaction on the performance.

by RAOUL J. HOFFMAN

THE question of the effect of the slipstream of the propeller on the performance of the airplane becomes increasingly important as the ratio of the wing area affected by the propeller stream to the total area is getting larger and larger. This increase of influence of the air-swept area is largely due to the tapering of the wing, the use of multimotored drives and the reduction of the aspect ratio of the wing.

In order to visualize the influencing factor and the interaction of the slipstream with the airflow over the wing, we bring a few sketches showing the airflow past an airfoil and through a propeller.

Fig. 1 shows the velocity gradients of the air around an airfoil at low angle and Fig. 2 at high angle, the decrease and increase of velocities noted on the curves. They make it quite evident that increasing the velocity over the upper surface will increase the lift.

Fig. 3 shows the velocity increase of the air passing through a propeller. This increase is the slip-stream which gives us the required thrust. We notice an outer zero line past which we find a small region of reverse flow; the inner zero line passes through the 25 percent of the diameter, past which we find a turbulent center region. Placing a body (fuselage) into this turbulent region the efficiency naturally will increase.

The propeller in order to give momentum to the air backwards must give a certain tangential motion to the same air column, which will result in a helical motion of the air. This helical motion is plotted in Fig. 4 for a certain propeller at three-quarters of its diameter.

The helical motion is the reason for offsetting the rudder and for having a different span loading on the left and right wing when a single tractor propeller is used (see Fig. 5).

It would be simple to equalize the flow by changing the entering edge, as shown in Fig. 6 or by guiding the airflow with vanes. Giving the vanes sufficient reverse curvature they could be applied to helicopter to remove the torque created by a single lift-propeller.

There is always a dividing line present (Fig. 7) between the upper and lower airflow which changes according to the angle of attack and the blunter the nose is, the easier the shifting is; therefore, for low speed ratios a sharper leading edge should be used.

To retain the efficiencies of the propeller and wing when placed in close proximity their original airflow characteristics should not be altered. We know that the propeller produces

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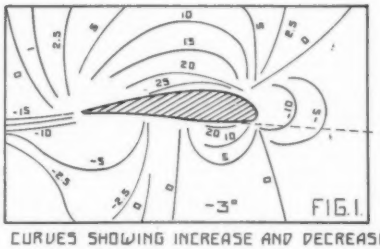
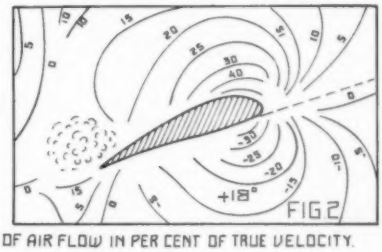
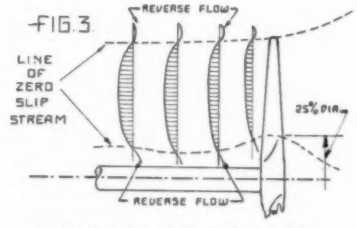
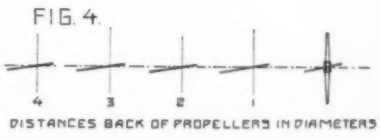




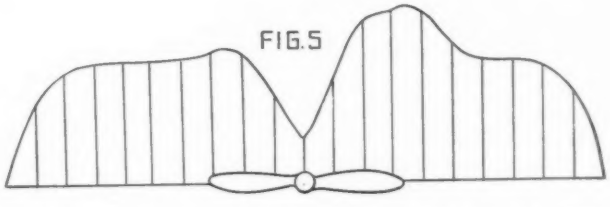
CURVES SHOWING INCREASE AND DECREASE OF AIR FLOW IN PER CENT OF TRUE VELOCITY.



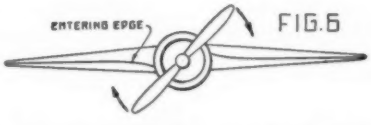
FLOW OF AIR THRU PROPELLER



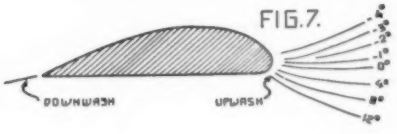
TWIST OF SLIP STREAM AT 3/4 DIAMETER



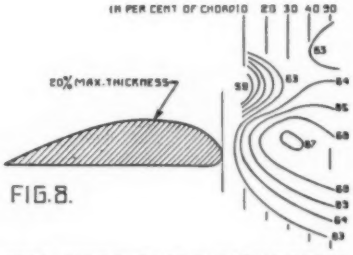
RELATIVE LOAD DISTRIBUTION OF TOTAL FORCES ALONG SPAN ON UPPER WING OF A BIPLANE



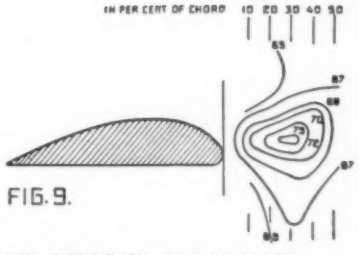
CHANGE OF ENTERING EDGE TO EQUALIZE AIR FLOW



DIVIDING LINE BETWEEN UPPER AND LOWER AIR FLOW



TOTAL EFFICIENCY AT CLIMBING SPEED



TOTAL EFFICIENCY AT HIGH SPEED

California Gas Model Meet a Success

by JESS LAUGHLIN

The Winners. LEFT TO RIGHT. Clyde D. Goehring, 2nd place; Howard Broughton, 4th place; David Fletcher, Jr., 1st place; Ira J. Hassad, 5th place and V. V. Hiatt, 3rd place.

BEGINNING at 8:00 A. M. Sunday morning, June 7th, and continuing until noon, the Midget Air Race Association put on an Air Meet that was as thrilling and interesting as anything Los Angeles has ever staged in the way of an aeronautical event.

There were over 100 entries, but few contestants failed to have their ships on the line when time came for the starter to flag them on their take-off.

Space does not permit a detailed description of the many beautiful and interesting models that were exhibited and flown there. Nor is it possible to include with the story a picture of more than a few of the gasoline-powered ships that competed. The models pictured herein are no more beautiful in construction or performance than others not shown.

The reason for the selection of the accompanying photos is explained by certain odd features of design that caught the writer's eye and ear.

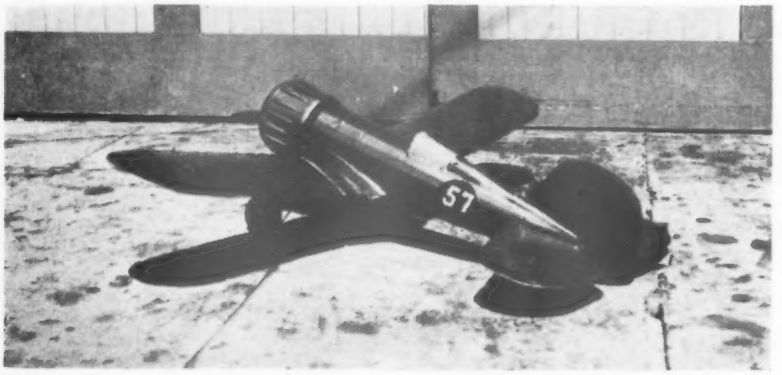
For example, an inspection of the Army Hawk Model shows a competing ship that was constructed and flown by Mrs. Evalene B. Hobart, 1533 South Western Ave., Los Angeles. Mrs. Hobart's model performed nicely.

The winner, David Fletcher, Jr., age 12 years, won highest honors with a high wing monoplane of original design. Mr. David Fletcher, Sr., acted as technical advisor in its construction.

Another little scale flying model which attracted a lot of attention was the gold colored Wedell-Williams racer. This ship was an exact miniature of "57" with which Roscoe Turner set numerous records for speed. Its builder was Santiago D. Abrenica, a young Filipino. With it he amassed over 70 points in the contest.

The Vale, Italian purship model, was another outstanding ship. Painted lavender, it was characterized by a decided

(*Continued on page* 59)



The completed "57" gas model racer, built by Santiago D. Abrenica. A beautifully constructed model and a very impressive flyer.

Materials for Rearwin Gas Model

by PAUL W. LINDBERG

COMPLYING with the request of many of our readers, we attach the following list of materials for building the POPULAR AVIATION Rearwin Gas Model.

As a further convenience for intending builders of this model, the location of each piece or its purpose is marked opposite to each of the items.

My suggestion is to first study the list and then consolidate all of the materials of one dimension into total lengths, that is, the smaller pieces employed for bracing, and so forth. The large structural materials, such as the wing spars, longerons, etc., must be ordered to the length listed.

FUSELAGE

Basswood	Pieces
3/8"x1 1/8"x1/2"	1 Block to hold batteries
1/4"x1/4"x34"	5 Longerons
1/4"x1/2"x9 1/16"	2 Front landing gear struts
1/4"x1/2"x7"	2 Rear landing gear struts
1/4"x1/2"x2"	2 Blocks for gas tank
1/4"x1/2"x1 7/8"	2 Cross piece at top of landing gear strut
1/4"x7/8"x31/2"	2 BASS
1/4"x3/4"x31/2"	1 BRACES ACROSS
1/4"x1"x31/2"	1 FUSELAGE
1/4"x2"x2 1/4"	1 Battery case block
1/2"x2"x31/2"	1 Landing gear block
1/8"x2 1/8"x5"	1 PLYWOOD VENEER
1/4"x6"	2 DOWEL
Balsa	**Pieces**
1/4"x1/4"x34"	8 Fuselage bracing
1/4"x3/4"x3 1/16"	2 Top of Fuselage Cabin
1/4"x1"x4 1/2"	1 Battery Back Center
1/4"x2"x12"	1 Bracing
1/8"x1 3/4"x4"	1 Former (1)
1/8"x1 1/16"x4"	1 Former (6)
3/8"x2"x24"	1 Former stock
1/16"x3/4"x14"	8 Stringers

WING

Bandsawed	
Rib (A) 3/16" thick	28
Rib (B) 1/8" thick	4
Rib (C) 1/16" thick	2
Rib (D) 1/32" thick	2
Balsa	
1/8"x1/2"x34 1/2"	2 Rear spar
1/8"x3/4"x34 1/2"	2 Center spar
1/4"x3/4"x27 1/2"	2 Leading edge
1/16"x3/8"x30"	2 Trailing edge
1/16"x3/8"x4"	1 Cabin trailing edge
1/4"x1/2"x27 1/2"	7 Bracing
1/4"x1 1/2"x30"	1 Wing tips, etc.
1 1/8"x1 1/2"x1 1/8"	2 Root leading edge block
1 1/8"x1 1/2"x5"	2 Tip leading edge block
3/4"x1 1/8"x1 1/8"	2 Rear root tubing block
1/16"x1 1/8"x1 1/8"	2 Root trailing edge block
3/4"x1"x1"	2 Rear strut fitting block
5/8"x3/4"x1"	2 Front strut fitting block

RUDDER

Balsa	Pieces
3/8"x1/4"x8"	4
1/16"x1 1/4"x8"	1
1/4"x1 1/2"x9"	1
1/4"x3/4"x4"	1
1/4"x1"x8"	1

ELEVATOR

Balsa	
1/16"x1 3/8"x21"	3
1/8"x1 3/8"x21"	3
1/16"x1"x16"	1

WING STRUTS

1/8"x1/2"x22"	4 Bass

PROP BLOCK

5/8"x1 1/8"x12"	1 Spruce or Bass

SHEET METAL

6"x26"	1 .006" sheet alum.
2 3/4"x7"	1 3/64" sheet alum.
1/16"x2"	2 3/64" sheet alum.
1/2"x1 1/4"	1 3/64" sheet alum.
1/2"x7/8"	2 3/64" sheet alum.
1 1/2"x5/8"	4 3/64" sheet alum.
3/8"x5/8"	1 3/64" sheet alum.
1/4"x5/8"	2 3/64" sheet alum.
3/8"x1/2"	4 3/64" sheet alum.
1/16"x1/2"	4 3/64" sheet alum.

SHEET METAL

Tin	
7/8"x6"	1

SPRING BRASS

1"x3"	1

(*Concluded on page* 66)

A Model 9-Cylinder Engine

Here is a gold mine of information for our model engine mechanics. A 9-cylinder operative gasoline aero engine model fully described and with complete working drawings and erection photos.

by CLYDE R. GARL

THE great number of inquiries received from readers of POPULAR AVIATION requesting information on the 9-cylinder radial engine described under my name in the February issue, prompted me to prepare detail drawings for this engine and to take assembly photographs that would satisfy the interest of my correspondents.

If it is a thrill to see your first airplane model fly, it is a thousand times more thrilling and satisfying to see your model engine turn over on its first trial run. I believe that there are but few amateur craftsman projects that give so much pleasure and enduring satisfaction as building an operative model gasoline engine.

While a 9-cylinder model may seem an overly ambitious project, yet it is not such a big contract after all, for many of the parts are duplicates and can therefore be made much more rapidly than entirely different parts, with variation in design. If every individual cylinder were of a different type or even different in minor details, the job would be much more arduous than it actually is with this model.

In presenting my working drawings for radial aircooled 9-cylinder engine, I make no claim as to the perfection of the model design or of following scale from a large engine. My primary objective is to acquaint the great body of amateur aviation enthusiasts with the essential mechanism and working principles of the most popular type of aviation engine in use today. I also wish to pass on to my fellow model builders, the fruits of my labors so that they may, by using my design as a stepping stone, carry on my pioneer work with this type of model.

A front view of the one-horsepower miniature radial airplane engine that contains 700 parts and took one year to build. This is certainly a most beautiful job.

A side view of the model radial engine which employs a distributer instead of a magneto. This is not simply a dummy model but actually runs.

Space does not permit the publication of complete and fully dimensioned working drawings of each of the parts. Only the main parts are shown in detail and the construction of the minor parts will be left to the ingenuity of the builder. This is for the reason that the real model builder will enjoy the products of his labors more thoroughly if he contributed part of the design himself than if he slavishly followed in detail, the exact dimension of every bolt and nut on my engine.

The accompanying assembly photographs, taken from the parts of my model will, I believe, convey more information than a multitude of line assembly drawings. This applies particularly to the assembly of the connecting rods and wrist-pins and to the machining of the crankcase which are, at the best, quite difficult to show by a drawing.

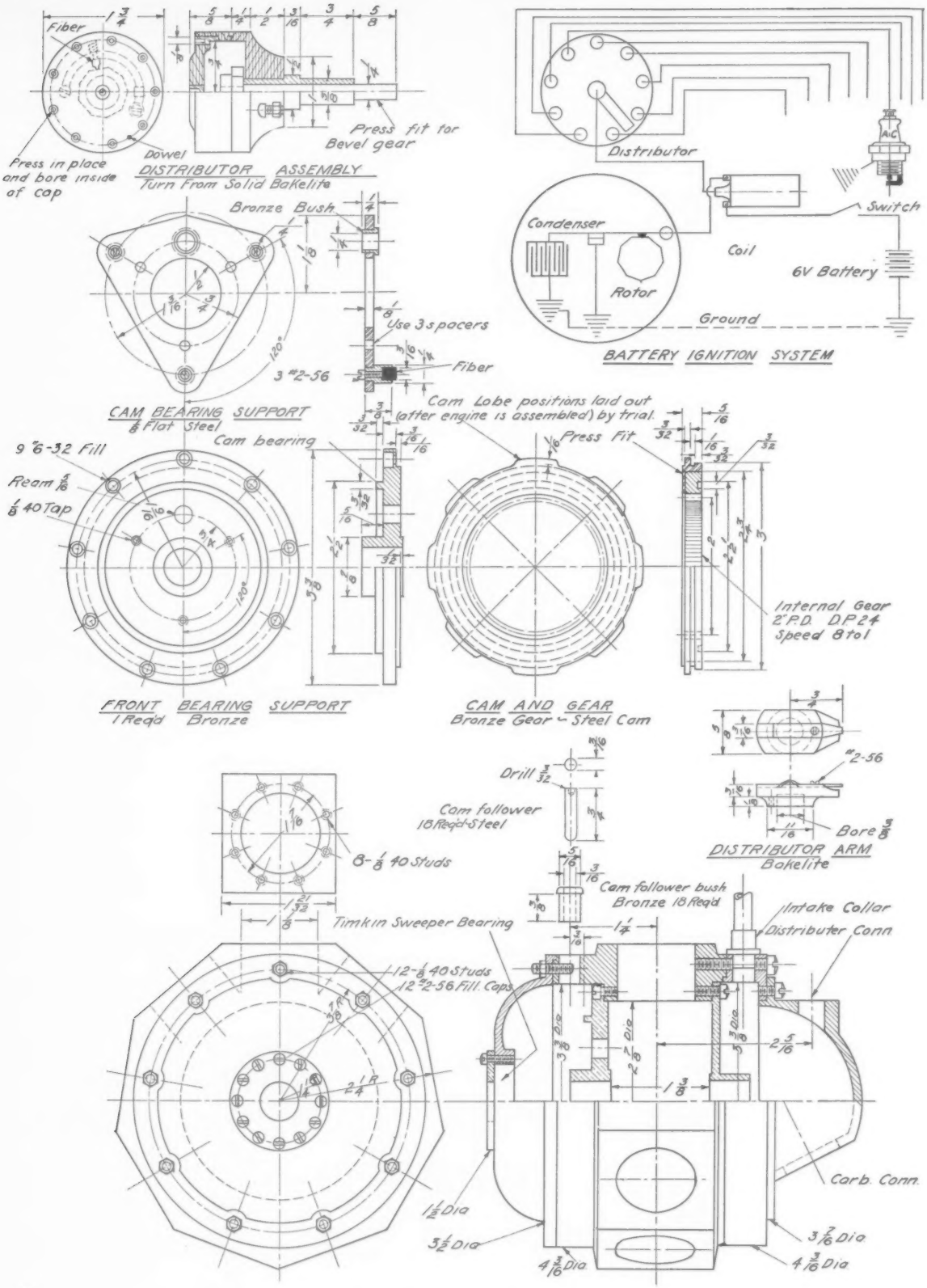
As to the length of time and the number of parts in the engine, I wish to inform my readers that this engine contains 700 parts and that it took one year to build, working during my spare time. It develops one horsepower, having a piston displacement of 7.92 cubic inches. The bore and stroke of the engine is 1". x 1⅛" and the compression ratio is 5:1. The overall diameter is 10½".

As with most radial engines of this type, the firing order is 1-3-5-7-9-2-4-6-8. Thus, the uneven number of cylinders fire alternately through two complete revolutions and the crankshaft rotation of my engine is clockwise.

Only a very few adaptations from stock parts were used. Timken sweeper bearings were used for the main crankshaft bearings and the carbureter was a modified gasoline-powered lawnmower carbureter. With the additional exception of the sparkplugs, all the rest of the engine was built by me.

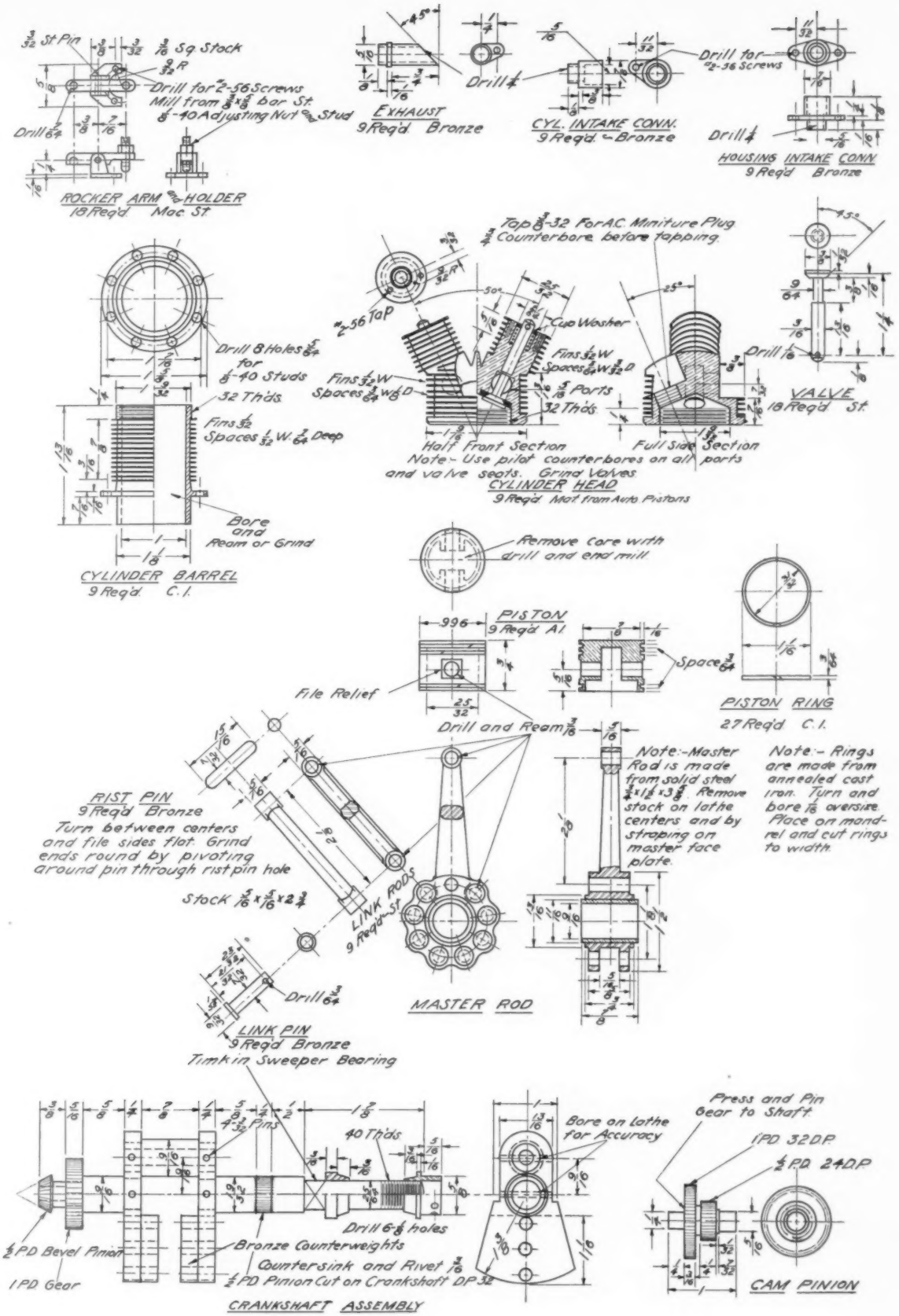
Generally, the spark-coil will prove the sticking point for many builders because it is no small job to get the required number of turns of the very fine wire into the small available space. These coils, and the condensers with

(*Continued on page* 46)



Note:- Index CYL. openings, Cam rod bush, and intake openings on milling machine.

CRANKCASE ASSEMBY


ROCKER ARM & HOLDER
18 Req'd Mac. St.
EXHAUST
9 Req'd Bronze
CYL. INTAKE CONN.
9 Req'd Bronze
HOUSING INTAKE CONN
9 Req'd Bronze
CYLINDER BARREL
9 Req'd C.I.
CYLINDER HEAD
9 Req'd Malt from Auto Pistons
Half Front Section
Full Side Section
Note - Use pilot counterbores on all ports and valve seats. Grind Valves.
VALVE
18 Req'd St.
PISTON
9 Req'd Al.
PISTON RING
27 Req'd C.I.
Note:- Rings are made from annealed cast iron. Turn and bore 1/16 oversize. Place on mandrel and cut rings to width.
WRIST PIN
9 Req'd Bronze
Turn between centers and file sides flat. Grind ends round by pivoting around pin through rist pin hole
LINK RODS
9 Req'd St.
Note:- Master Rod is made from solid steel 3/4 x 1 1/4 x 3 3/8. Remove stock on lathe centers and by strapping on master face plate.
MASTER ROD
LINK PIN
9 Req'd Bronze
Timken Sweeper Bearing
CRANKSHAFT ASSEMBLY
CAM PINION
1 PD Gear
1/2 PD Bevel Pinion
Bronze Counterweights
Countersink and Rivet 3/16
1/2 PD Pinion Cut on Crankshaft DP 32
Drill 6-1/8 holes
40 Thds
Bore on lathe for Accuracy
Press and Pin Gear to Shaft.
1 PD 32 DP
1/2 PD 24 DP

them, can be obtained from model supply dealers at a reasonable cost.

Cutting the gear teeth is another problem for the builder who has only limited shop facilities, but if the gear blanks are turned down to size, they can be sent to a gear cutting concern for this work. The rest of the job is plain sailing for the man with a lathe, drill press and similar metal working equipment.

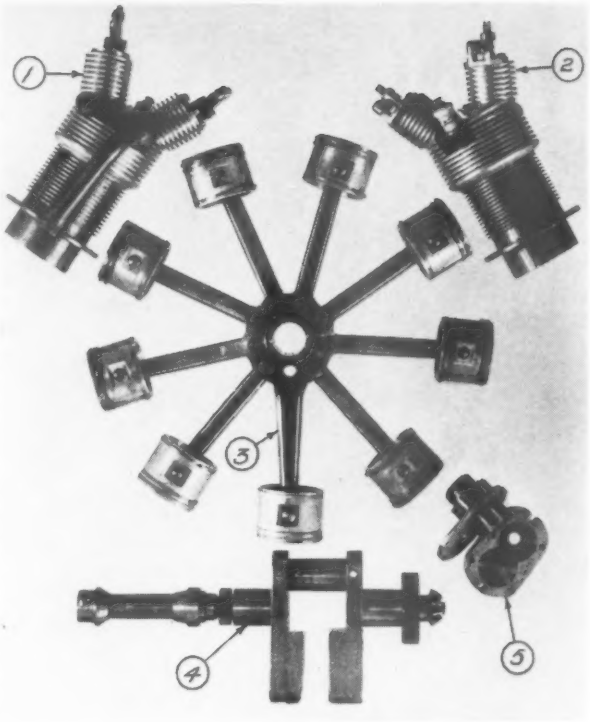
As radial engines do not carry an oil level in the crankcase as in automobiles or other engines, the dry-sump method is used in the big aero engines and is copied in this model. In short, the lubricating oil is forced through the hollow crankshaft by a gear type oil pump and small holes in the crankshaft lead the oil to the various parts requiring lubrication. The excess oil drains into the small sump or reservoir located between the two lower cylinders and is then pumped back to the oil reserve tank by the gear "scavenger" pump.

Since there seemed to be no prospect of building an effective working ignition magneto small enough to be in keeping with the scale of this engine, battery ignition was substituted for magneto ignition with good results. The details of this battery system are shown on one of the drawing sheets.

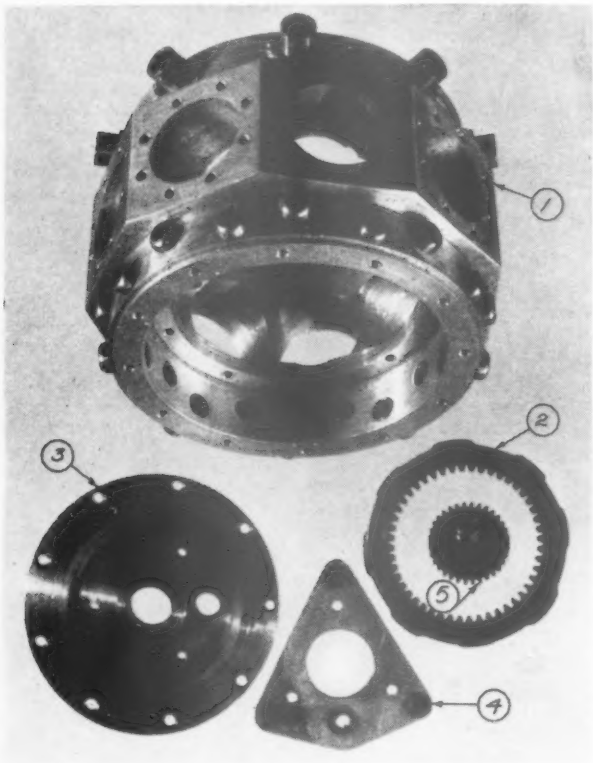
A 6-volt battery is used for the ignition system, and both the battery and the bakelite distributer can be made less conspicuous by mounting them in the pedestal or base. It is important that high tension ignition cable be used for all high voltage lines for it is just as difficult to insulate the high tension current on the model as on a large engine.

The efficiency of the engine depends upon the proper mixture of gasoline and air and upon maintaining the proper degree of compression. This particular model is equipped with a small carbureter from a lawn-mower engine, but a mixing jet and valve can also be used if a carbureter of this type is not available.

It is highly important to have the valves seat squarely and they should be lapped into their seats with a perfect surface. These cylinders are so small that the smallest possible leak will ruin the compression value and without compression, the engine cannot be expected to function properly.



(1) Rear view of the cylinder assembly ready for mounting on case. (2) Front view of the same cylinder assembly. (3) Master connecting rod and its assembly. (4) Crankshaft assembly showing counterweights. (5) Gear type oil pump assembly.



(1) Completed crankcase. (2) Cam mounted on internal gear. (3) Front crankshaft and cam bearing support. (4) Cam pinion bearing support. (5) Cam pinion and gear.

The photograph in the upper right-hand corner of this page shows the connecting rod assembly very clearly, the master-rod and banjo ring being one unit as indicated at (3). The master-rod (3) being a rigid part of the banjo ring, prevents the latter from rotating and therefore affords a non-rotational connection for the wrist-pins of the remaining connecting rods shown pinned in place on the assembly.

The side elevation of the single-throw crankshaft (4) shows the counterweights inside of and attached to the cheeks of the crank-throws. Just to the left of the arrow will be seen the gear pinion that drives the valve mechanism. The banjo ring fits on the wrist-pin of the crank, and in this way all cylinders can effectively act on one crank and in one plane.

At the left will be seen the machined and completed crankcase, bored for the end rings and cylinder skirts and faced off on nine sides for the cylinder flanges. The ferrules for the push-rods are shown in staggered rows below the main case. This part is machined out of one piece of steel and is the most complicated and difficult part to finish.

At (3) is the finished end rings that carries the crankshaft and camshaft bearings. The lip of this ring is a tight fit in the bore of the crankcase and it is then bolted to the side of the crankcase, by studs threaded into the case. The cam-gear bearing is the large hole intermediate between the tongue of the ring and the central crankshaft bearing. At (4) is the idler cam pinion support.

At (2) is one of the most interesting parts entering into the assembly, for here we have the cam-ring with internal gear teeth on the inside of the ring and the nine cam-lobes on the outer surface. The intermediate cam gear (5) engages both with the crankshaft pinion and the internal gear teeth on the cam-ring.

The exact form of the cam lobes will depend upon the timing of the engine and must be worked out.

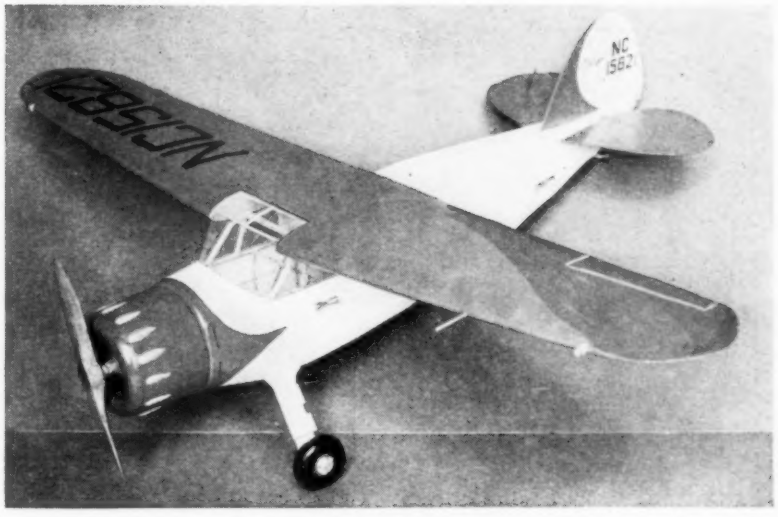
END.

Building the Cessna C-34

by

PAUL W. LINDBERG

Model Editor and Model Designer for
POPULAR AVIATION



This is the completed Cessna C-34 cabin job, a dandy flyer and an exact replica of the big ship as will be seen from the front cover.

THIS month's model, the Cessna C-34 cabin plane, like most high-wing monoplanes, is a fine flyer—stable and with good distance getting qualities. In appearance, it is all that the model builder could ask for as it preserves the trim keen outline of the full size ship.

As to the color scheme, I believe that the front cover drawing is the best guide to this part of the construction, for Mr. Bollin has been very careful in picturing the exact tints of the original.

FUSELAGE CONSTRUCTION

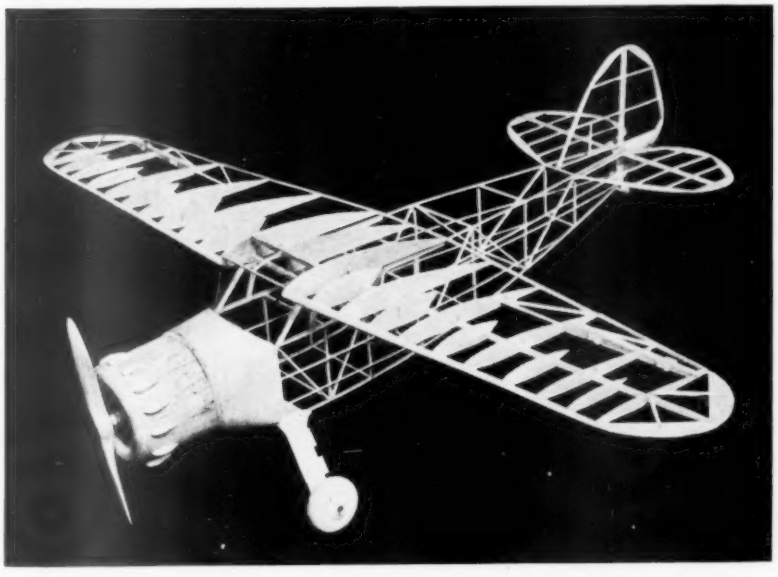
To prevent the parts from sticking on the accompanying plans when using them to build your model, place a piece of wax paper over the plans and, thus protected, the plans can be used indefinitely. The plans are drawn to the scale of: ¾″ = 1-foot, or in other words, each ¾-inch on the drawing corresponds to a 1-foot measurement on the full size plane.

The fuselage members are made with $\frac{1}{16}$-inch square balsa, and all of the parts are held securely in place on the plan by pins until the parts are finally secured by the application of the cement. Stiff paper is used for covering the forward part of the fuselage as indicated on the plans.

WING CONSTRUCTION

The ribs are to be cut carefully to the detailed contour shown on the plans from $\frac{1}{32}$-inch sheet balsa. The spars are then secured to the drawing and the ribs are then cemented into their proper position on the spar. The leading and trailing edges are now sanded to shape and cemented to the ribs. It will be noted that the wing panels carry independent ailerons which, when adjusted, are of great assistance in controlling the flight of the model.

The wing tips are made of $\frac{1}{16}$-inch thick balsa, and this is to be recommended because it is easy to construct and makes a tip of much neater appearance than by the usual method of construction. The wing tips bear the brunt of the shock in the case of a bad landing and therefore they should be very carefully made.



The photo of the Cessna framework will be of assistance in assembling your model.

ELEVATOR AND RUDDER

The parts of the tail assembly are made of $\frac{1}{16}$-inch balsa and are laid out by building them up over the drawings with wax paper to protect the drawings. The construction is very simple and there should be no difficulty experienced at this point.

It is essential that the vertical fin be lined up true with the centerline of the fuselage and that the stabilizer is parallel with the wings to avoid any tendency toward overturning or oscillating in flight. The final adjustment of these controls are made, of course, after the first trial flight.

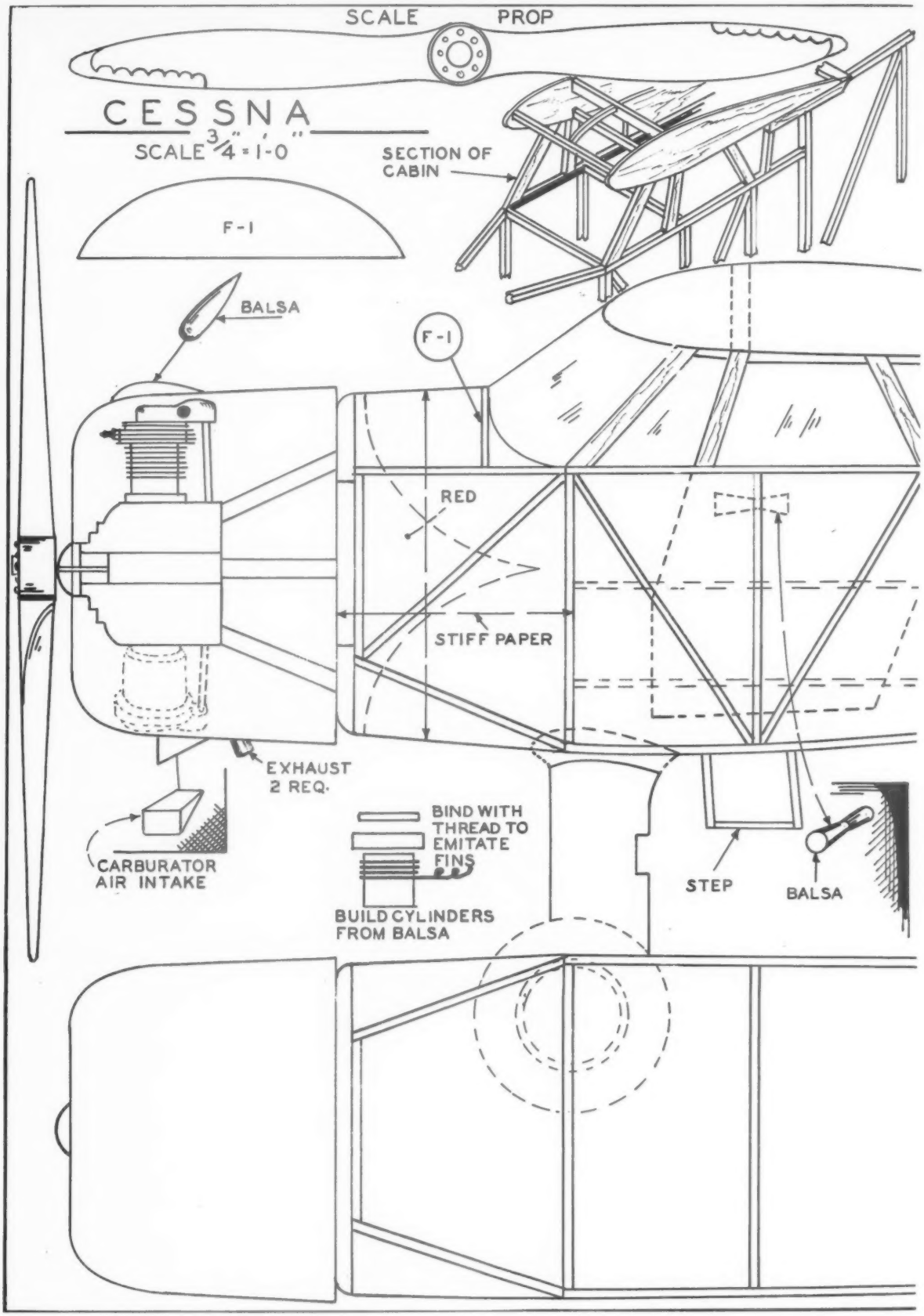
CONSTRUCTION OF MOTOR

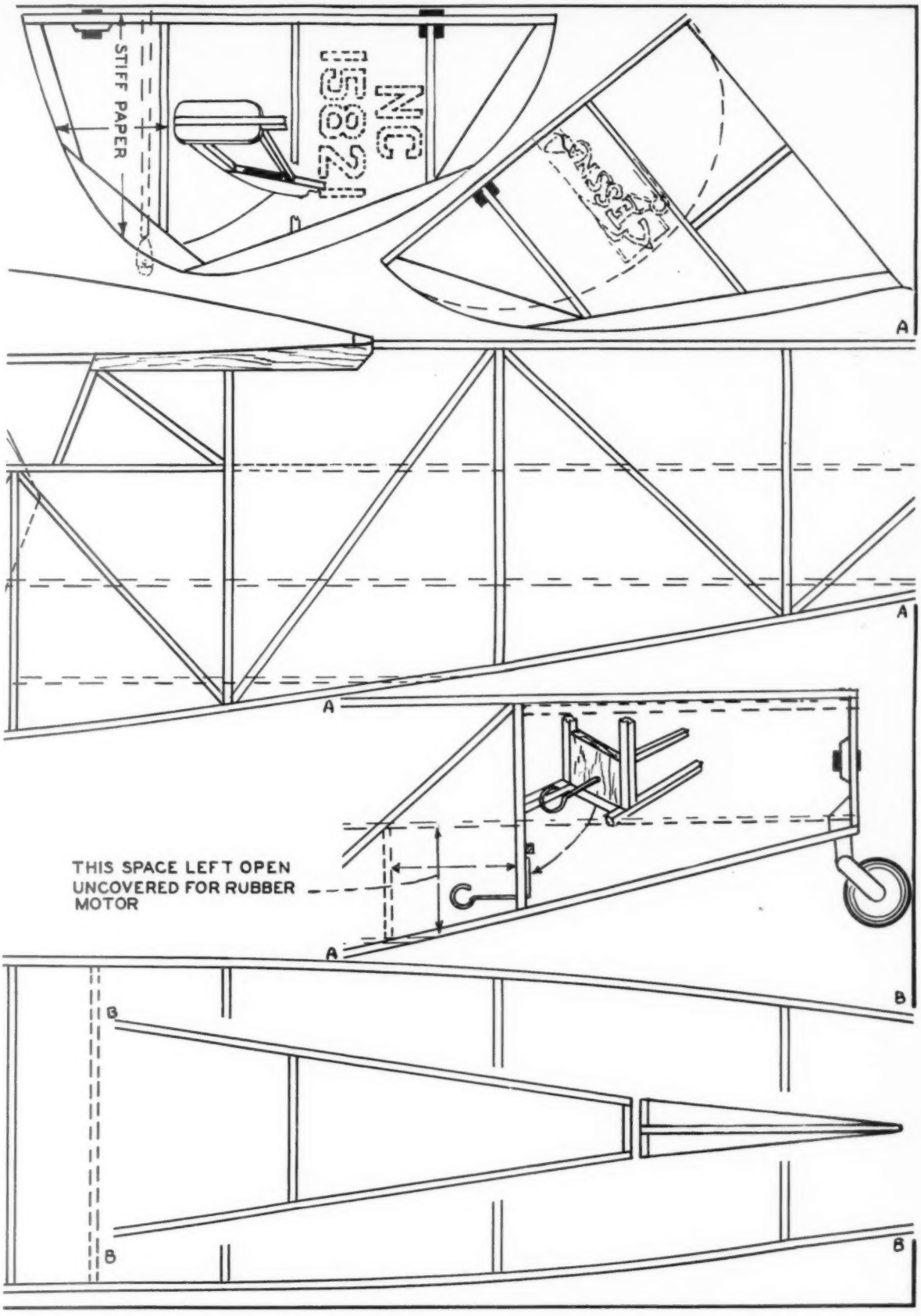
While the motor is not plainly visible from all angles, because of the deep cowling, it adds much to the realism of the plane when viewed from the front and adds the touch of completeness, so much desired by the model builder.

The motor is built completely of balsa blocks, cut into cylindrical form and then wrapped with thread to give the blocks the appearance of the real finned cylinders. A small cap piece (shown in detail) is then cemented to the top of the cylinder to imitate the valve-rocker housing and from this housing, thin strips of round balsa or cane are run to the crankcase to represent the pushrods.

The crankcase is a round balsa block having the outlines indicated on the side elevation. This view also shows the cylinder assembly with the thread "fins". The carbureter intake is a scoop shaped box located below the cowling. Two

(*Concluded on page 73*)


SCALE PROP
CESSNA
SCALE 3/4" = 1'-0"
SECTION OF CABIN
F-1
BALSA
F-1
RED
STIFF PAPER
EXHAUST 2 REQ.
CARBURATOR AIR INTAKE
BIND WITH THREAD TO EMITATE FINS
BUILD CYLINDERS FROM BALSA
STEP
BALSA


STIFF PAPER
A
A
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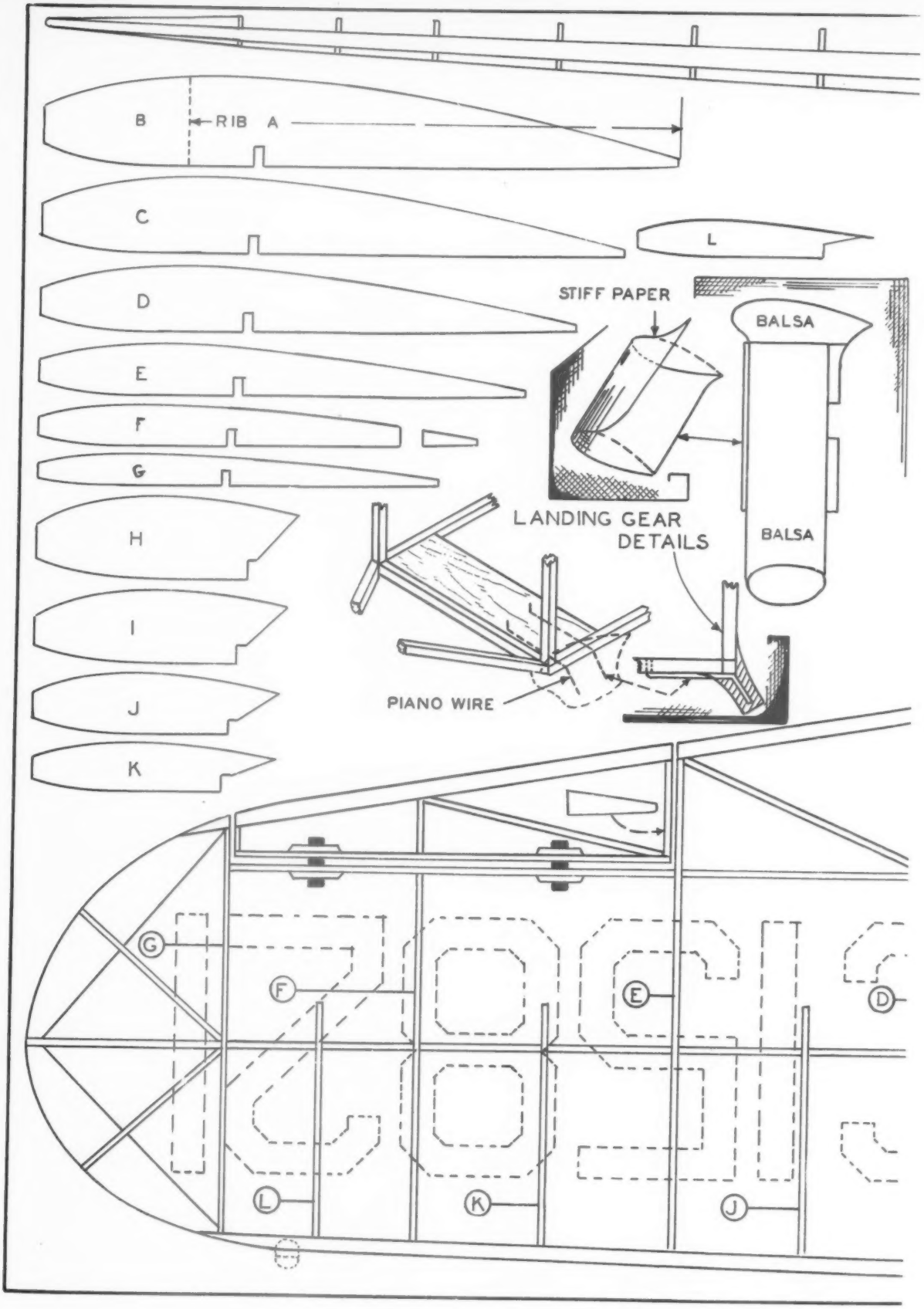
THIS SPACE LEFT OPEN
UNCOVERED FOR RUBBER
MOTOR
B
B
B


B
RIB A
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STIFF PAPER
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LANDING GEAR
DETAILS
PIANO WIRE
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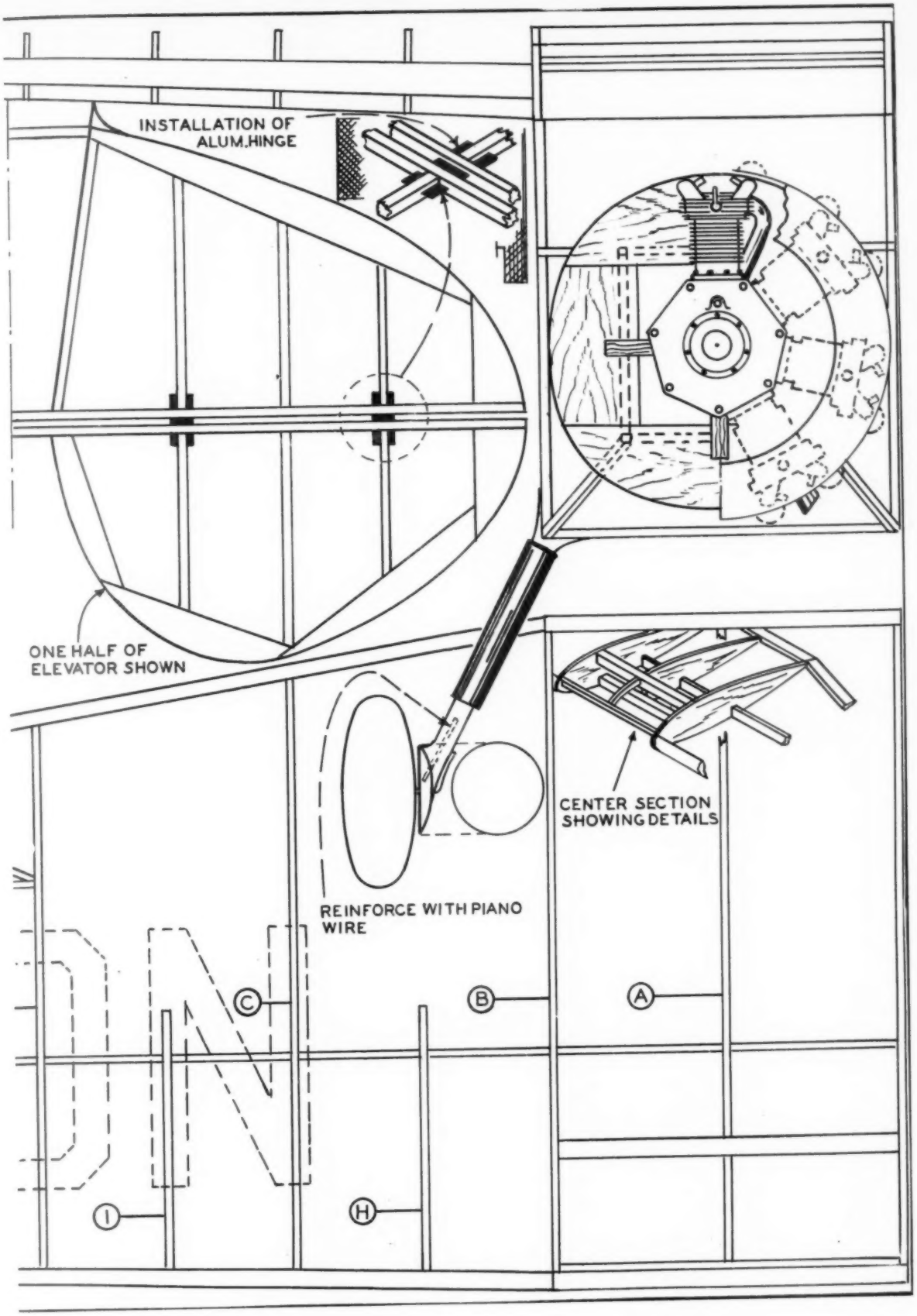

INSTALLATION OF
ALUM. HINGE
A
ONE HALF OF
ELEVATOR SHOWN
CENTER SECTION
SHOWING DETAILS
REINFORCE WITH PIANO
WIRE
C
B
A
I
H

Data on Low-Speed Airfoils

by RAOUL J. HOFFMAN

THE speed attained with our modern airplanes is the result of the vast amount of theoretical and laboratory work on various wing sections and component parts.

Viewing our sketches of cross-sections of airfoils, since the Wright brothers made their systematic flights, we notice that the concave lower surface has disappeared, which may be due to the increased speed, speed-ratio and the necessarily increased structural strength.

Model builders, however, do not have to contend with such peremptory premises, since most flights are performed at low speed and at nearly the same angle of attack. Rubber driven microfilm models flying at low speed (two or three feet per second) use single curved surfaces. Other models use arched elliptical surfaces with great success.

In order to compare the effectiveness of model and airplane airfoils, we note the formula for the resistance of an airfoil or body exposed to the airstream, assuming a similar geometrical and aerodynamical airflow. These functions have been evolved by a number of scientists such as Froude, Dine, Allen, Reynolds, Prandtl, etc., with a clear conception of certain laws governing the variation in size.

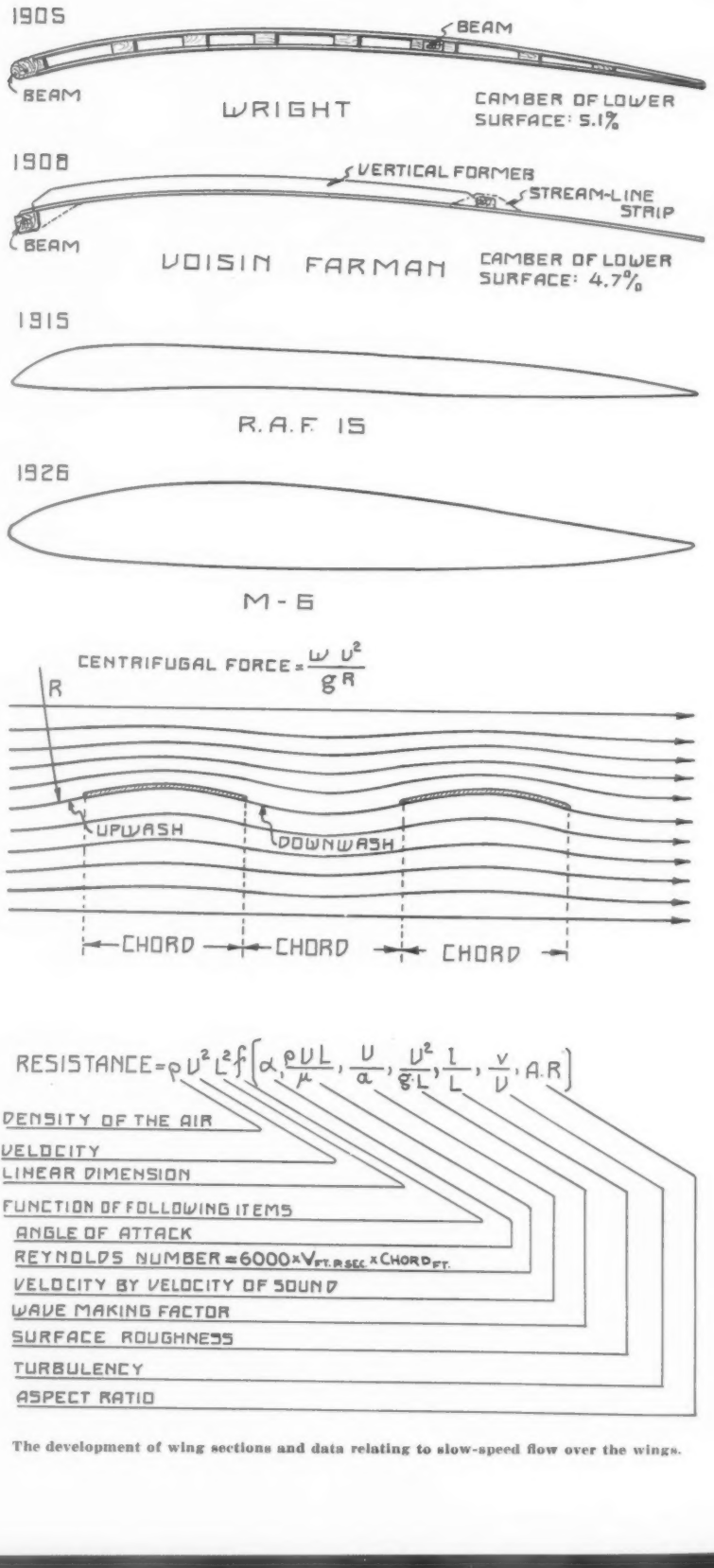
Most of the laws were evolved from a series of experiments and for high speeds, the Reynolds number is found to be correct if the regions of turbulency are similar. It seems that for low speeds the Reynolds number can not be applied.

For a compromise and for simplicity, let us assume a harmonic motion of the airflow of undamped waves (sine waves). The upwash, always present on lifting surfaces, will have a certain radius (R), which will create a centrifugal force. This centrifugal force will tend to break the stream away from the lower surface which will create turbulencies or a double wave airflow at certain speeds. In order to have the airstream cling to the lower surface, the ratio of "speed-squared" and the radius must always be the same. In other words, the greater the speed, the greater the radius will have to be or the flatter the curvature of the airfoil.

This means that, for high speed, the lower surface will be flat, making a very inefficient airfoil. Up to a certain speed, only, the lower surface is changed. The upper surface is left as it was at low speeds.

Comparing the formula for the centrifugal force with the wave making function in the resistance equation, we find the similarity by assuming that (R)

(*Concluded on page 60*)



The development of wing sections and data relating to slow-speed flow over the wings.

Another View of the Duplex Airliner

A three-quarter front view of the "Quad" and the auxiliary plane carried on its back. A glance at the engine lineup will show that the auxiliary is by no means a small plane itself.

SEVERAL months ago, we gave a brief description of and also an artist's sketch of the radically new British Empire flying boat, being built by Short Brothers, Rochester, England, for Imperial Airways, Ltd.

The accompanying photo, however, gives a much better idea of these mammoth flying boats which carry auxiliary mailplanes on their backs. The smaller mailplane, but by no means small, has a non-stop radius of 5,000 miles. When the larger passenger boat reaches its passenger destination, the mailplane continues on to the further mail destination under its own power.

There is, at the present time, 28 planes of this class under construction at the Short Brothers plant which will be put into service throughout the British Empire within a few months.

Ryan "S-T" Proves a Popular Plane

The widespread popularity of the Ryan S-T planes, with the resultant heavy increases in factory orders, has made it possible for the Ryan Aeronautical Company to announce price reductions of $400 on the 95 h.p. model and $300 on the 125 h.p. installation. The former prices of $4,385 and $4,685 respectively are now reduced to $3,895 for the 95 h.p. model and $4,385 with the 125 h.p. installation. These prices include full equipment with wheel pants, complete stream lining, compass, air speed, airwheels, dual controlled wheel brakes, as well as wing flaps and tab trimming controls which are standard features.

These new prices make the Ryan S-T the highest performance ship in this price bracket on the market today. In addition to these price reductions, the Ryan Aeronautical Company is working on a time payment purchase plan which is expected to make possible the purchase of Ryan planes on the same accepted installment basis as the present day automobile contract.

As a result of this reduction, it is also announced by the Ryan School of Aeronautics that their famous Deluxe Combination Course No. 5 which has heretofore included a 95 h.p. new Ryan S-T plane together with complete Government Approved transport training at a combined cost of $4,642 will now be available at a new low combination cost of

(*Concluded on page* 54)

Autogiro Pick-Up Device

THE ability of the autogiro to practically come to a dead stop in the air has greatly simplified the methods of picking up and delivering messages, mail sacks and other articles between aircraft and ground crews.

Recently, at the U. S. Naval Air Station, Washington, D. C., it was shown to be possible for an autogiro to drop a cable over the side of the cockpit while it flew at an altitude of about 100 feet.

When the container attached to the cable came within reach of a member of the ground crew, the giro hovered almost motionless while he detached the container without taking more than a half dozen steps forward. In a similar manner it was demonstrated that the container could be picked up.

A New Cutting Attachment

A NEW oxy-acetylene cutting attachment, the Oxweld CW-22, is now being marketed by the Linde Air Products Company. It can handle sheet metal as well as very heavy work with all of the efficiency of a full size cutting blowpipe. It operates on low-pressure and medium pressure acetylene with equally satisfactory results.

Priced for quick sale. One Model "C", 4-place cabin Waco, Jacob's powered. Total time, 250 hrs., 20 hrs. since major overhaul. Price, $3,000.
W. H. FALLEN
1408 9th Ave., S. Fargo, N. Dak.

Summertime in Chicago...

Overlooking Lake Michigan, the great inland ocean—away from disturbing street noises—The Stevens offers you Chicago's finest hotel location—in the very center of things—on famous Michigan Boulevard.

We're old-fashioned at The Stevens, that is, when it comes to cheerful hospitality—but new in spirit. A friendly staff of employees interested in your comfort will make you enjoy every minute of your visit.

You'll be amazed at the many distinctive Stevens features at rates as low as two-fifty for one—four dollars for two.

Overnight parking, 50c—garage with pickup and delivery, 75c.

THE STEVENS
CHICAGO
WORLD'S LARGEST HOTEL

Twin Wasp

(*Continued from page 30*)

ing the air at high speed through the cooling fins.

The inherent smoothness and the absence of any critical vibration period in the crankshaft at operating speeds eliminates the necessity of using a vibration dampener.

As examples of the outstanding performance of the Twin Wasp and Twin Wasp Junior, the world record-breaking 3,600-mile flight of the Navy Consolidated boat equipped with Twin Wasp engines from the Canal Zone to San Francisco without stop, and the repeated Trans-Pacific flights of the Pan American Clipper Ships, are typical and are ample evidence of the proven quality and efficiency of the two-row type. The mere fact of their general selection for this type of service is evidence of their superiority.

Looking to the future, we see both military and commercial requirements calling for still higher horsepower. The inevitable trend on the part of all engine manufacturers therefore will be toward the two-row type or other multi-cylinder arrangements.

Practically every large airplane now under construction, or being contemplated, is designed around two-row engines. This includes multi-engine craft for military and naval purposes as well as commercial designs, and flying boats as well as land transports. We are on the threshold of a new era in radial air-cooled engine design, for the two-row type has the same possibilities for future development as the single row engine had a decade ago.

END.

Fairchild "45"

(*Continued from page 27*)

anteed within 3 percent. under standard atmospheric conditions).

High speed (sea level) 320 h p.	180 m.p.h.
Cruising speed (5250 ft.) 220 h.p.	173 m.p.h.
Rate of Climb	1100 ft./m.
Take off distance (40 degree flaps)	580 ft.
Take off distance (without flaps)	680 ft.
Stalling speed (with flaps up)	59 m.p.h.
Stalling speed (with flaps down)	54 m.p.h.
Landing speed (flaps down)	49 m.p.h.
Service Ceiling	18,000 ft.
Absolute Ceiling	20,000 ft.

END.

Ryan Plane

(*Continued from page 53*)

$4,242. The 125 h.p. Ryan is now available on this same combination plan at the $4,642 price which was formerly charged for the 95 h.p. job.

With a manganese bronze rod the strength may be somewhat greater, averaging about 46,000 lb. per sq. in., but the porosity in the metal increases. However, the all-purpose welding rod containing silicon will consistently give welds in the usual grade of steel tank plate of over 5,000 lb. per sq. in.

In many cases the bronze-welded joint strength has been well over 65,000 lb. per sq. in. The ductility for this special bronze rod is in excess of 30 percent.

Due to the soundness and excellent wearing quality of the weld metal given by this rod, surfaces built-up with it are found to possess increased resistance to wear. The average Brinell hardness value for this rod is about 96. Because of the soundness and freedom from porosity, welds can be machined to give a surface entirely free from blemishes after the finishing out. This is of exceptional advantage for wearing surfaces.

END.

READER'S SERVICE PAGE

ROOSEVELT FIELD
MINEOLA, LONG ISLAND
NEW YORK

From New York
35 Minutes by Rail
45 Minutes by Car

"World's Premier Airport"

(*Continued from July*)

Following the transfer of the then infantile Air Mail Service to Heller Field, Newark, it looked a little as though commercial aviation on Long Island was due to suffer complete stagnation. Save from Bert Acosta's occassional test work for the Curtiss Aeroplane & Motor Company, situate hard by old Hazelhurst Field, civilian flying was frightfully sporadic. All in all de-militarization was the idea in mind for the day, with possibly an eventual fold-up.

At that time crates of Jennies were pouring into the field in a steady stream, being returned to the Curtiss Co., under Army contract. And the wooden hangars were filling fast with these crates—meaning boxes this time.

Once the hangars were filled to the bursting point it became evident that something should be done about getting rid of them preferably for cash. So the Curtiss Company cast about for a method of selling them along with aviation selling as a whole.

Thus the Curtiss Flying Service was born. They changed the name of the lower section of the Plains to Curtiss Field, placed one Charles S. "Casey" Jones at the controls and opened shop. It was the beginning of a long uphill climb that is due to be set down as one of pioneer aviation's brightest chapters.

(*Continued next month*)

SACRIFICE SALE
Certified Licensed Used Airplanes
Waco Custom, 1935; 285 Wright, controllable propeller, radio, special paint, many other extras
Waco Custom, 1935; 285 Jacobs, prepared for radio, special paint
Waco Custom, 1935; Wright powered; fully equipped for blind flying
Waco F6; 225 Jacobs, special gas, prepared for radio
KR-34, Moths, Robins, Privateers, Monocoupes and many other types, as low as $500.
Trade or terms to responsible parties.
Write for new time payment purchase plan
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Used Planes Aerial Photography
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HANGAR C GARDEN CITY: 6876

Propeller Wash

(*Continued from page* 41)

changes in velocities and placed in the vicinity of the wing will change its lift.

The lift is increased if the propeller is placed above the wing but it will add extra drag due to the supports for the motor. Placing the motorhousing below the wing will result in minimum drag increase, which will be offset by the reduction of the lift due to the slip-stream.

The combination of all efficiencies concerned, the efficiency of the propeller, the added drag, and the increase of lift can be grouped into a net efficiency. This net efficiency is plotted in Fig. 8 for high angle and in Fig. 9 for low angle; combining the two test results we find that the best average position will be 30 percent of the chord length ahead of the wing.

Viewing the lower part of the efficiency lines closer we find they coincide with the dividing lines for the airflow past a wing.

The correlation of airflow of propeller and wing combination, different for various wing sections and propeller pitch ratios, will help you to explain some of the poor performances of some of the designs, to grasp the trend in latest improvements, and will be of great aid in putting the final touch to your own airplane.

Very interesting experiments on these effects were performed several years ago by the Engineering Division of the U. S. Army Air Corps with a full size plane. Pressure zones were plotted out for the ship under all conceivable positions, including power-dives and 90-degree banks.

In all cases, the results were practically in agreement with the facts as stated here, and it is therefore of the greatest importance to consider this factor seriously before completing a design.

END.

READER'S SERVICE PAGE

FLOYD BENNETT FIELD

MUNICIPAL AIRPORT No. 1
BROOKLYN, NEW YORK

Phone: Nightingale 4-3600

"New York's Air Pride"

(*Continued from July*)

After Floyd Bennett Field had been suitably christened, with fitting ceremonies led by the late Peter Brady, most everybody waited for the oratory to float away in the breeze and the expensive tract to revert to its original Barren Island status.

This cynical air, however, was to float away in the breeze. The airport, once established, became an active site on the very bumpy road to the Rockaway ferries. That there was a crying need for the field was borne out by the fact that many people were more than willing to endure the bumpiness of Flatbush Avenue east of Avenue U.

First the Naval Reserve unit in the New York district made a very happy landing on the well-equipped field. Prominent commercial fliers swooped down for a nesting place and, to everyone's surprise, business followed them.

About then the trans-oceanic fliers began to look at this spot in Jamaica Bay with appreciation. Wiley Post was one of the first of these to seize upon the advantages of a long concrete runway for load take-off.

(*Continued next month*)

HOLD EVERYTHING!
If You Expect to Learn to Fly, Visit the A. E. Club Rooms and Library in the Administration Bldg.
Send 3c for American Escadrille Monthly Bulletin—or 35c for Membership and Cadet Flight Brochures
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Composed of America's Present and Future Air Pilots
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Hangar No. 3, Floyd Bennett Field, Brooklyn, N. Y.
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POPULAR AVIATION ON SALE IN THE LOBBY OF ADMINISTRATION BLDG. CALL THERE FOR IT.

Scissors Type

(*Continued from page* 18)

wings would come the automatic retraction of the landing wheels into their wells in the wing bottom.

After the closing of the wings has been completed, the plane would be held in the same gliding angle until 250 m.p.h. was attained and the plane, with its greatly reduced area, would have sufficient speed to handle the gross weight and ability to maneuver well at that altitude. Then, instead of adding hundreds of horsepower to a fixed wing plane to get increased speed, I reduce the drag so that the same motor can rev up the propeller with a higher pitch setting and get the same m.p.h. with less fuel.

It will be necessary to develop a synchronizing mechanism that will insure a uniform opening and closing of the right and left hand wing assemblies and to procure the proper relation of the top and bottom halves of the wing-section. This will give a resultant coincidence of the vertical center of pressure and propeller thrust line during the entire opening and closing of the wings.

After several experiments, however, I have developed a mechanism which will leave the wings free to absorb landing shock when in the open position with the wheels out for landing or take-off and which will, at the same time, afford a rigid cantilever wing structure when the wings are closed for speed flight.

As a whole, therefore, the structural elements work out very well in relation to the correct functioning of the lifting surfaces, much better in fact than would be thought at first glance. In particular, the greatest burden (in landing) is solved.

The controls that are to be used in this plane in its ultimate stage are the private control surfaces which were flight tested in 1931 at Greenleaf Field, Jacksonville, Alabama. They were found very successful and showed a great reduction in the drag and performance, especially on aircraft capable of a high top speed. The Arcuate control will eliminate drag produced by the angular hinged control surfaces and will produce a maximum deflection of airstream with a minimum of burbling. This control has been patented and patents on other improvements and developments have been applied for.

END.

Air Board

(*Continued from page* 22)

"Let the Air Commerce Bureau improve on its functions of regulation and maintenance of aids to navigation. The funds and personnel available to the Bureau for these purposes are adequate. Regarding the Development Section of the Bureau and its initiation of the $700 airplane, its experience in this line has put the Bureau in a position where its efforts should bear fruit in the near future. The handling of development work has to be carried on from a long range viewpoint." (E. B. W.)

The further consideration of this topic promises to lead to heated discussion and a conclusion which should be of considerable interest.

TOPICS FOR FUTURE CONSIDERATION

The Air Board has only begun its deliberations, but it will have no difficulty in finding topics worthy of consideration and ruling.

How may the safety of private flying be increased, yet regulation in construction and operation be made less burdensome?

Should there be an attempt to provide crashproof cockpits and cabins?

How may emergency communication be provided in transoceanic flying?

Should pursuit planes be abandoned now that bombers of almost equal speed and overwhelming armament are available?

What part should women play in aviation?

There will be no dearth of useful work to undertake, particularly as suggestions come in from the aviation minded public.

END.

A Million This Year

At this very moment, while you are reading these words, well over a thousand people are flying the airlines of our country. *Before the year is out, well over a million passengers will be served.* This will be more than double the number carried in 1934.

When you take your first air trip you will marvel at the efficiency and courtesy which greet you at every step. Note, too, the perfection of aircraft, engines and propellers which speed you on your way.

UNITED AIRCRAFT
MANUFACTURING CORPORATION
Makers of
WASP AND HORNET ENGINES
HAMILTON STANDARD PROPELLERS
VOUGHT CORSAIRS • SIKORSKY AIRLINERS
EAST HARTFORD, CONN., U. S. A.

CHICAGO AREA

Curtiss-Reynolds was, in its prime, one of the best of America's A 1 A airports . . . Major R. W. "Shorty" Schroeder "launched" this mile-square airport in 1930 . . . some 15 miles northwest of Chicago's city limits, Curtiss-Reynolds originally was a part of the elaborate Curtiss-Wright corporation which wielded aviation's big stick in 1929 and 1930 . . . since Curtiss-Wright slumped and "Shorty" Schroeder went first to another Chicagoland field (Sky Harbor) and then to the Bureau of Air Commerce at Washington, Curtiss-Reynolds has changed hands many times. . . .

Today this field is operated by a local corporation headed by Harold Darr and Gilbert Owsley . . . chief pilot is one of aviation's veterans, Dwight Morrow . . . Darr and Owsley also are the local Stinson and Aeronca agents. . . .

Next month: Pal-Waukee Airport.

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CURTISS AIRPORT

We Cannot Supply the Demand for our Graduates

HERE ARE THE REASONS

WILL ONE OF THESE JOBS BE YOURS ?

DOUGLAS AIRCRAFT COMPANY

December 28 1935

Major C C Moseley
Curtiss-Wright Technical Institute
Glendale California

Dear Major Moseley

Recent contracts awarded our Company added to military and commercial contracts already on hand are forcing a rapid expansion of our personnel and a stepping up of our production for at least two years Thousands of trained aircraft men, especially sheet metal workers will have to be added to our payrolls

During the past several years we have employed a large number of your graduates and found them eminently satisfactory Will you please advise how many graduates you will have available monthly beginning this summer and for the next eighteen months thereafter?

Efficient workmen capable of working with the care and precision demanded by our Company are the product of thorough training and are difficult to find You are to be congratulated on the fine job your Institute is doing in turning out such men

Yours very truly

Douglas

NORTH AMERICAN AVIATION, INC

INGLEWOOD, CALIFORNIA

March 26, 1936

Major C. C. Moseley, President
Curtiss Wright Technical Institute
Grand Central Airport
Glendale, California

Dear Major Moseley:

You may be interested to learnior that graduates of the Curtiss Wright Technical Institute have merite' very favorable consideration by our company.

We have given your graduates priority because we have carefully checked all the men we have hired, as well as having inspected your trainior courses, and we are totally of the opinion that your trainior meets all of our rigid requirements for highly skilled trained aircraftsmen.

We are interested in knowior when you have graduates available, since we probably will be needior men in increasior quantities from now on.

Yours very truly,
NORTH AMERICAN AVIATION, INC.

J. H. Kindelberger
President

Los Angeles Examiner

Thursday May 7, 1936

7500 AIRCRAFT JOBS OPENING IN SOUTHLAND

Demand for Skilled Artisans Great; Special Employment Department Will Be Set Up

With the six most important aircraft firms in Southern California approaching peak production, 7500 new jobs will be available within the next few weeks, the California State Employment Service announced yesterday.

So great is the demand for skilled artisans in the industry that the employment service is setting up a special department to handle it

J. J. Millette, department attache, went through the plants and analyzed the dexterities necessary to each job. Then the personnel department, under the direction of W. J. Walmsley, dived into the ocean of application cards and came up with information valuable to employer and prospective employee.

Employment service officials pointed out that the shortage of aircraft workers will shortly be matched by an equal need for automobile builders.

"confessir to the
kidnapin appeared
grand jury again to-

ments made by

ADVISORY COUNCIL

Donald W. Douglas, President, Douglas Aircraft Co., Inc.
John K. Northrop, President, Northrop Corporation
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T. P. Wright, Director of Engineering, Curtiss-Wright Corporation
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HERE IS YOUR ANSWER

Never before has the Aviation Industry faced such a serious shortage of trained men.

This is *your* opportunity. If you are considering an aviation career take advantage now of specialized training that is approved by the men who will use your services, and capitalize on this unusual opportunity.

Both the Aeronautical Engineering, and Master Mechanics' Courses at Curtiss-Wright train you in the shortest possible time for positions most in demand and which pay the best salaries. These courses are recognized by the entire industry and Curtiss-Wright is approved as a Department of Commerce ground school and repair station, by the California State Board of Education for State teachers' training, and is affiliated with the State Junior Colleges granting college credits—a recognition unsurpassed by any other aviation school.

Enrollment at Curtiss-Wright is limited in order to maintain this high standard for which the school is famous. Students benefit tremendously because of these facts. Positions are frequently arranged for students before they leave school and for many months Curtiss-Wright has been unable to supply the demands for its graduates.

This is your big opportunity, but time is precious. This situation may not come again and someone else may get the good position you could have had. Act now and send the coupon today for full information. * *Audaces fortuna juvat timidosque repellit.*

*Fortune favors the bold and repels the timid. Mail the coupon.

CURTISS-WRIGHT TECHNICAL INSTITUTE
GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIF.
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GRAND CENTRAL AIR TERMINAL · GLENDALE · LOS ANGELES · CALIFORNIA

Rocketry

(*Continued from page 26*)

nature of small Rocket-propelled, all-metal gliders, rather than the customary tubular rockets.

Willy Ley, who designed the rocket motor and in general engineered the experiment, is a recent arrival from the rocket fields of Europe where, due to the backing given the science by the German Ministry of Defense, great strides have been made.

The Versailles treaty greatly limited the Germans' activities in naval development, aviation and artillery. In place of battleships, they developed a "pocket" navy, in place of aeronautical training they substituted gliding and soaring, and their activities in rocketry signify an attempt to find a substitute for artillery.

Consequently, rocket shots were made almost daily from a rocketdrome on the outskirts of Berlin. These experiments culminated in the historic flight of Otto Fischer, in a 24 foot rocket ship from the island of Rugen to a height of about 32,000 feet, in 1933. This was the first time in history that a man ever left the earth in a rocket—or at least the first time one ever returned alive.

This success in rocketry is significant because it shows just what can be done when the efforts of the various experimenters are brought together and concentrated on a single experiment, and when these efforts are properly financed.

In view of the tremendous possibilities of rockets—in high speed transportation of mail and passengers; in the obtaining of samples of the stratosphere (valuable in meteorological research); and in cosmic ray research, it is surprising to the author that greater interest and more substantial backing is not provided by those interested in the progress of science in this country. It seems unfortunate that most workers must depend upon the subscriptions of members of the various societies, or upon funds raised from the sale of stamps and post-cards to collectors, who treasure them because of their historical value.

Accompanied by Mr. B. D. Levi, of Chicago, I recently went to the offices of POPULAR AVIATION.

"Something should be done about it," agreed the editor, "I believe the readers of POPULAR AVIATION are far-seeing enough to appreciate the possibilities of rocketry. I'll run your article telling of the formation of the American Institute for Rocket Research, and we'll see what the readers think of the idea."

So here's the article, and the question now is what do *you* think about it?

Steps are being taken to affiliate the various individuals and societies working on rocketry and if enough interest is shown, there is no reason why we who now live cannot see the day when rocket ships, laden with mail and passengers, travel the stormless, fogless, and cloudless stratosphere at speeds measured in thousands rather than in hundreds of miles per hour.

Factories

(*Continued from page 28*)

ing, and great hangar doors, 35 feet high, which, when opened, will give unobstructed clearance for the full width of the building at the Boeing Field end.

Including the power house, the new unit will add 61,750 square feet to the Boeing floor space, bringing it to a total of 397,750 square feet. The Austin Company is in charge of construction.

According to the company's plans, component parts for its commercial and military planes will continue to be constructed at the present Boeing plant, then will be trucked to the new structure for final assembly.

END.

SCALECRAFT FLYERS

These "wonder" models are full 3 feet beauties . . . they fly for three minutes or more . . . supplied complete with aluminum cowl, carved props, printed wood and simplified plans . . . a perfect model builder's kit for a perfect model.

36" MONOCOUPE (145) only **$1.25** plus 25c postage

36" POST-ROGERS LOCKHEED only **$1.50** plus 25c postage

1936 CATALOG *Packed with Quality Values*

The greatest catalog in our history. Crammed with values . . . at prices that defy competition. Quality merchandise only . . . that's why we supply the parts for the champions . . . they know that only quality parts build winning models.

FREE just send us your name and address . . . we'll do the rest.

TYPICAL VALUES from the MODEL BUILDERS "BIBLE"

BALSA WOOD (If 36" lengths are desired just double 18" price)

18" BALSA STRIPS
1/32x1/16..100 for .05
1/16x1/16..100 for .05
1/16x1/8...22 for .05
1/16x3/16..20 for .05
1/16x1/4...17 for .05
3/32x3/32..21 for .05
1/8x1/8....20 for .05
1/8x3/16...14 for .05
1/8x1/4....10 for .05
1/8x3/8.....8 for .05
3/16x3x16..10 for .05
3/16x1/4....8 for .05
3/16x3/8....6 for .05
1/4x1/4.....8 for .05
1/4x3/8.....5 for .05
1/4x1/2.....4 for .05
1/2x1/2.....3 for .05

18" BALSA PLANKS
1" x1".....1 for .07
1" x2".....1 for .11
1" x3".....1 for .15
1" x6".....1 for .25
1½"x1½"....1 for .15
2" x2".....1 for .20
2" x3".....1 for .25
2" x6".....1 for .45
3" x3".....1 for .40
3" x6".....1 for .75

COLORLESS CEMENT
1 oz....05 20 oz....08
4 oz....15 1 pt....50

BAMBOO
1/16 sq. x12" 35 for .05
1/16x1x11 ....1 for .01
1/16x1/4x11 12 for .07

SANDPAPER Per package...05

18" BALSA SHEETS
1/64x2 5 for .10
1/32x2 7 for .10
1/16x2 7 for .10
3/32x2 6 for .10
1/8 x2 5 for .10
3/16x2 4 for .12
1/4 x2 3 for .11
1/2 x3 2 for .12

BALSA PROPELLER BLOCKS
¾x ¾x 57 for .05
½x ¾x 57 for .05
½x ¾x 67 for .05
⅝x1 x 73 for .05
⅝x1 x 82 for .05
¾x1¼x10 1 for .03
¾x1¼x12 1 for .04
1 x1½x15 1 for .07

COLORED DOPE White, yellow, orange, red, green, olive drab, blue, black, silver, gold. 1 oz. ..... .05 2 oz. ..... .10 4 oz. ..... .19 1 pt. (16 oz.) .60

CLEAR DOPE 1 oz. ..... .05 2 oz. ..... .07 4 oz. ..... .13 1 pt. (16 oz.) .45

THINNER SAME PRICE AS CLEAR DOPE, FINEST PARA RUBBER
1/32x1/32 30ft..05
225 ft. skein..30
.045 sq. 20 ft..05
225 ft. skein..40
3/32 flat 20 ft..05
225 ft. skein..40
1/8 flat 17 ft...05
225 ft. skein...55
3/16 flat 12 ft..05
225 ft. skein..80

FLANGED BUSHINGS Doz.
⅛ diam. x 3/16 .05
⅛ diam. x 7/32 .08
⅛ diam. x ¼ .10
⅛ diam. x ½ .20

ALUMINUM LEAF (.0003 of an inch in thickness, 3½ wide) 5 feet for.... .05

SHEET ALUMINUM Thickness .002" 6x6 1 for .04 .005" 6x6 1 for .05 .010" 6x6 1 for .06

JAPANESE TISSUE White or colored 2 for 5 Per dz..18

SHEET CELLULOID 6"x8"..10 12x16..25

MUSIC WIRE (straightened) .014, .020, .028, .034 6 feet ..... .03

THRUST BEARINGS (small or large) Each ..... .01½ Per doz. ... .15

MODEL PINS Per package. .05

DOWELS
⅛ dia.x 6" dz. .05
⅛ dia.x12" dz. .09
⅛ dia.x18"2 for .03

REED
1/16" dia. 10 ft. .05
3/32" dia. 8 ft. .05
⅛" dia. 6 ft. .05

INSIGNIA SHEET 12 pr. and Rudder and Tail markings, with gummed back, each only.... .05

WASHERS
¼ O.D. doz. .01 Per gross ... .10
¼ O.D. doz. .01 Per gross ... .10

BALSA BALLOON WHEELS (Machine Turned)
½" dia. per pr. 3c
¾" dia. per pr. 4c
1" dia. per pr. 5c
1⅜" dia. per pr. 7c
1⅞" dia. per pr. 12c

CELLULOID PANTS For ¾" or 1" wheel .....15c For 1⅜" or 1⅞" wheel 30c

ALUMINUM TUBING
1/16" O.D. per ft. 9c
⅛" O.D. per ft. 7c
¼" O.D. per ft. 8c
⅜" O.D. per ft. 10c
¼" O.D. per ft. 10c

CELLULOID WHEELS
¾" dia. pr.. 5c
1" dia. pr.. 7c
1⅜" dia. pr.. 10c
1⅞" dia. pr.. 16c

DUMMY RADIAL ENGINES
1½" dia. 18c
2" dia. 23c
3" dia. 34c

CELLULOID MOTOR AND DRAG LINK COMBINED
1½" dia. 15c
3" dia. 25c

CAST PEDESTALS for all size solid models Each 10c

MODEL BUILDERS RAZOR KNIFE Each 10c

BOMBS
⅝" long 4c ea.
1¼" long 9c ea.
3" long 14c ea.

2 BLADED PROPS
1½" ..... 9c ea.
2½" .....14c ea.

3 BLADED PROPS
1½" .....10c ea.
2½" .....15c ea.

PURSUIT MACHINE GUNS ea.
¾" Pursuit Gun 5c
1" Pursuit Gun 5c
1¾" Pursuit Gun 10c

SWIVEL GUNS
¾" long .. 5c ea.
1" long .. 5c ea.
1¾" long ..10c ea.

DIE CAST WING & TAIL LIGHTS 3 pc. to a set for 12" model ..10c ea. 15" model ..20c ea. 24" model ..30c ea.

MOTOR NOSE PLATES ea. For 1½" motor..10c For 2" motor..15c For 3" motor..20c

ALUMINUM COWLINGS

Anti-Size	drag	Open	Clad
1½"	20c	20c	20c
2"	25c	25c	25c
2½"	25c	30c	30c
3"	30c	35c	35c

CARVED PROPS
5" 5c
6" 6c
7" 7c
8" 8c
10" 10c
12" 12c

FREE With every order of $1.50 or over, 250 ft. of the finest fresh ⅛ flat Para Rubber, free. Add 10c for handling charge of Free Rubber. Free supplies with all other orders.

How to Order— Add 15c to orders under $1.50. Orders over $1.50 add 10% of order. Canada 10% extra. 36" lengths 10c extra. Add 10c for packing charge of free rubber.

FREE Send for our special gas catalog.

HEATHE MODEL AIRPLANE CO.

438-A8 East 98th St. - Brooklyn, N. Y.

"SENSATIONAL"

For SPECTACULAR Flights Build This REARWIN Speedster Gas Model

Span 6 feet 1¾ inches Length over all 42½ inches

Build a gas powered model that really looks like the big ships; not just another gas model. A very stable flyer plus a high gliding angle.

Construction set contains full size working plans, ready cut out ribs, rubber tire air wheels, aluminum motor mount, sheet aluminum for cowling, special metal fittings, veneer, all balsa parts cut to correct size, tubing rods, springs for shock absorbing landing gear and clear and colored dopes. This fine kit is complete down to special bolts, screws and many other parts too numerous to mention here. HIGH QUALITY and REAL VALUE for only COMPLETE KIT $7.00.

COMPLETE KIT INCLUDING BABY CYCLONE MOTOR $22.75

Add 50c extra to cover cost of packing and mailing.

The Baby Cyclone or any light model engine can be installed in this Rearwin Model.

AVIATION PRODUCTS CO.

619 S. Federal St. CHICAGO, ILL.

Gas Models

(*Continued from page 42*)

sweptback, tapered high wing. Its performance was easily comparable to its good looks.

Other models which gave evidence of technical excellence and construction technique were: F4B4, oldest gas powered, scale model in California; Red and White Fokker D VIII; Flying Wing with extremely large wing tabs, and wing tip rudders; Pusher with triangular tail boom and a third wheel in front to facilitate safe landings; Mister Mulligan, painted exactly like the big ship of the same name, and flying with the same zip and dash as its prototype; Aeronca Enclosed Cockpit (cabanne strut braced); Northrup Gamma; and—a high wing monoplane with at least 10 foot span.

The latter was powered with a one-cylinder engine, horsepower unknown. It took off after much adjustment, and amid the cheers of the crowd, crashed on the second from an altitude of about 10 feet. When it is realized that there is an actual racing plane which flies at 212 m.p.h., one can understand how garguantan this model appeared. It was so large that it easily might have carried a small child.

Thus far all mention of models has been about gas-powered planes. There were quite a large number of rubber-powered models, too, and of these one model stood out for its sheer beauty. It was a flying scale model of the Howard Hughes Racer. The little model was accurate in every detail, but its surpassing beauty lay in its unique covering. It was finished in smooth tin foil, with simulated rivets. The landing gear had recesses on the under side of the wing so the wheels could be folded flush.

After the precision and spot landing events were finished, there were several impromptu races between model owners on various parts of the field. These were done to give the news-reel and natural color cameramen a chance to get additional action on their film.

The crowd, which numbered from 3,000 to 5,000 persons, was quite a problem. They would invariably swarm out on the field when the contestants lined up for the take-off, and if they got out of hand then, it was mild when compared to the near riots that followed some of the more spectacular crack-ups.

The crowd really furnished the comedy relief. Some of the spectators who persisted in being on the field against orders were not as wary or cautious as they might have been, and when one of the little pursuit ships would turn back down wind after taking off, as often as not it seemed as if a stunt pilot was at the controls, for with a high whine the little ship would go on a "ground straffing" expedition straight at the trespassers.

Many were the men and women who buried their noses in the dirt, and arose with their plumage bedraggled, when one of the models came at them head-on.

As a final event, entrants sent up their planes with full gas tanks for the endurance contest. By this time there was a relatively high wind blowing, and the endurance planes, climbing in perfect spirals, were carried several miles to the south of the starting point. The winner, even though flying in large spiral turns, and who stayed aloft for the good time of 9 min., 30 sec., was retrieved at 123rd and Figueroa Streets—five miles distant from the airport.

The winner's name was Lee Atkins. The runner-up who took second place was Clyde Goehring, with a time of 6 min., 30 sec. These endurance ships climbed well over a thousand feet.

Reginald Denny, well known moving

ANNOUNCING!

McFarland Primary Glider Construction Kits

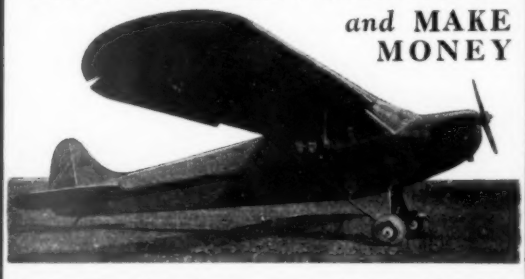
Regular Knockdown Kit, complete..$79.00
Sold in ten groups at $7.90 each.
Combination Kit No. 1 (with built-up ribs) $93.00
Sold in ten groups at $9.30 each.
Combination Kit No. 2 (with ribs and metal fittings finished).....$104.00
Sold in ten groups at $10.40 each.
Complete MCFARLANDS ready-to-fly "flyaway" $158.00
Complete MCFARLANDS ready-to-fly F.O.B. (crated) Greenville, Ohio $166.00

"Write for full particulars"

McFarland Aircraft Company, Greenville, Ohio, U. S. A.

The NEW "CUB" is SAFE • ECONOMICAL • STURDY • STABLE

Get into AVIATION *and* **MAKE MONEY**



The New CUB, with 20 major improvements, is America's SAFE Plane.

The FLEET *New* "CUB"

PAY JUST **$490** CASH

EASY MONTHLY PAYMENTS

we teach you FREE

Everyone would like to fly. Nearly everyone can afford to fly the New "CUB"—America's SAFE Airplane since 1925. Here's a plane that is the fastest selling air flivver in the world because it costs no more to buy than the average automobile. It costs no more to keep flying than the low-priced automobile of today. 20 to 25 miles to the gallon of regular gasoline. Oil consumption negligible. 90 m.p.h. with 2 people. Pilots and instructors pronounce the New CUB the ideal training plane. When you learn to fly in a CUB you know how to fly any ship. CUBs are flown every day in every state and in nearly every country. There's a CUB at nearly every airport and it's usually *flying*. AVIATION as a business is here NOW...and now is the time to get into Aviation.

Write for FREE FOLDER and Details

The Sturdy New CUB is EASY to FLY... EASY to BUY

TAYLOR AIRCRAFT CO.

No. 7 Aviation St., BRADFORD, Pennsylvania

CURTISS WRIGHT TRAINER

EQUIPPED WITH

GENERAL *Streamline* **AIRPLANE TIRES**

AIR minded people know the hard service that a training ship receives. Student pilots with the best of intentions are not always able to set it down easy. Curtiss Wright knows the responsibility that rests on tires in this kind of flying. They equip all trainers of this type with General Streamline Airplane tires.

General is proud to play a part in maintaining the reputation that Curtiss Wright trainers have achieved. General has solved the tire problem for a long list of the nation's foremost manufacturers and pilots. It will pay you to submit your problem to General—the air minded company that originated and perfected the famous streamline tire.

There are no safer tires built than Generals

GENERAL TIRE & RUBBER COMPANY

AKRON, OHIO • TORONTO, CANADA • MEXICO CITY, MEXICO

IF IT'S *streamline* **- IT'S A GENERAL**

picture star, was at the meet to watch the performance of three of his "Denny Planes." They gave splendid performances. (A detailed description was written about the "Denny Planes" in the May issue of POPULAR AVIATION.)

Gus Gotch, owner of the airport, and his operations manager, Nick Rose, were helpful, and did everything to assist the members of the press in obtaining their stories and pictures.

Officials of American Air Lines, Pan American, United, Transcontinental & Western Air, and the Aeronautics Branch of the U. S. Department of Commerce acted as judges of the various events.

In closing, it would be only fitting to quote a remark of Mr. Sanford B. Kellogg, Wing Commander and Founder of the Air Cadets. He said that one of the grandest things about boys building and flying model planes was the character building it provides.

He knows that the long hours spent in the workshop, analyzing plans, and working out details, sharpen the powers of thought.

He added, "When I see these bright, alert boys spend hours of patient, earnest effort in building model airplanes that are amazing in their accuracy, and when I see some little fellow send up his "ship" on its first hop, and it crashes, tearing up a wing or fuselage that will necessitate more hours of painstaking work to repair the damage—and when this little fellow takes it with a grin as part of the game—then you see character being built."

END.

Low Speed

(Continued from page 52)

be directly proportional to (L), the chord of the airfoil. From this we may state that, for comparison of low-speed airfoils, the ratio of speed-squared and the chord should be used instead of the Reynolds number.

It is obvious that the airfoil can not be placed directly with the streamlines, but in order to create lift the curvature will be changed to take an impact from the airflow on the lower surface and a suction on the upper surface. This qualifies for the second airfoil placed on the second wave, which is used as a stabilizing agent to a certain degree.

The sketch may help us in explaining some of the aerodynamic characteristics of the airfoil. The more closely the curved plate follows the wave of the airflow, the more stable the airfoil will be, but the less lift it will have. In case the first airfoil is extended past the inflection point made with a reverse curvature the stability will be increased to a point where the second airfoil may be dispensed with.

There are many good low-speed airfoils depending on the speed of the flow with the various degrees of concavity from 1/13.5 to 1/30 the Eiffel No. 35 and No. 38, then the U. S. 6 and various other sections.

This conception of airflow due to the viscosity (stickiness) of the air deviates to a certain point since the waves are damped after a few undulations with a certain turbulency, but it may be of great aid in future low speed man carrying airplanes of fixed structures.

END.

Readers' Letters

(Continued from page 22)

upon this invention so that it could be operated automatically by the cause of the trouble.

* * *

JOAN THOMAS, a contributor to POPULAR AVIATION *and now in France, writes to tell us some interesting facts concerning the Aero-Club de France, one of the pioneer aero organizations, and one of which most of our readers have heard. Here we are:*

The Aero-Club de France was founded in 1889 to encourage the development of aeronautics in all branches. It is largely due to the interest initiated by this club that France has become one of the most air-minded nations in the world.

The Aero-Club is housed in an old mansion at 6 rue Galilee, near the Arc de Triomphe. The two upper floors are occupied by the business offices and the archives of the organization while on the street level floor, the Tourisme de France maintains an office which furnishes information on air-travel, either private or commercial, in any part of the world.

The trophies that have been awarded for record flights, races and scientific development are kept here. They are of all sizes, shapes and designs and are variously of gold, silver, bronze, marble and crystal. The massive marble model of a dirigible, which was the Gordon Bennett trophy of 1906, is one of the most prominent and interesting of the trophies, as well as one of the oldest.

END.

Pat. Pend.

"IMP"
Reg. U. S. Pat. Off.

Model V-4
4 Cylinder

TORNADO MOTORS

Give You the Thrill of Powered Flight at Lowest Cost!!

Easily installed in any type Model, with Motor and Generator entirely out of sight. The simplest, surest, most reliable and lowest cost power unit obtainable; complete as listed below, nothing more to buy. Swings large propellers at high speed for long sustained flights; starts instantly; safe, economical. Runs on AC:CO Gas, generated by the "IMP" Generator. Will also run on compressed air, and is equally efficient for Model Boats.

Model V-4 (shown above) four cylinder. Weight only 3½ oz. Will fly models from 4 to 8 feet. Complete with Generator, Feed Line and Safety Clip... $7.50

Model S-2, two cylinder. Weighs 2½ oz. Flies models 3 to 6 feet. Complete with Generator, Feed Line and Safety Clip $5.00
(If ordered by mail, add 25c for postage.)

"IMP" 6 ft. Monoplane
Specially Selected Design for "IMP" TORNADO MOTORS

Selected from many designs as easiest to build, most practical and successful in flight. Designed by Hubert Owens for installation of "IMP" Tornado Motors; can also be powered with rubber motor. Complete Plan, ½ actual size with details full size, clear instructions and Specifications.
Regular Price, postpaid, 50 cents. With order for an "IMP" Motor 25c
(Special limited time offer)

Send 3 cents for New Catalogue Guide Listing lowest Prices on "IMP" Paulownia Wood Propellers, "IMP" Motors, Fittings and Specialties for Model Airplanes and Boats.

INTERNATIONAL MODEL CO.
1785 Broadway, General Motors Bldg., New York
British Agents for all "IMP" Products
MODEL AIRPLANE STORES
42 Derby Road, Prestwich, Lancs.

WE DEFY COMPETITION!

Prices Slashed to New Low Levels! Compare these sensational values!
And remember this: SKYWAY'S high quality remains the same in spite of extreme lowered prices. Save money, and get more! Order from this ad Now!

FREE! WITH ORDERS OF $1 OR MORE — SPRAY for Your MODELS or 1 DOZEN SHEETS JAP. TISSUE or MODEL BUILDER'S KNIFE

Take advantage of this special FREE offer now! Experience what a real pleasure it is to do business with a model airplane supply house that keeps promises! Every order is shipped same day received! All materials are of highest quality! Prove this to yourself! Learn why so many builders, dealers and clubs deal with SKYWAY! Dealers! Send for prices.

18" BALSA SHEETS
1/32x2 ..... 5 for 5c
1/16x2 ..... 5 for 5c
3/32x2 ..... 4 for 5c
⅛x2 ..... 4 for 5c
3/16x2 ..... 3 for 5c
¼x2 ..... 2 for 5c
½x2 ..... 1 for 5c

BALSA PROP BLOCKS
¼x3½x6 ..... 6 for 5c
½x3½x5 ..... 7 for 5c
⅝x1x8 ..... 3 for 5c
¾x1x8 ..... 3 for 5c
¾x1¼x12 ..... 2 for 6c
1x1½x12 ..... 1 for 6c
1x1½x15 ..... 1 for 7c

18" BALSA LENGTHS
1/16x1/16 ..... 125 for 5c
1/16x⅛ ..... 50 for 5c
1/16x3/16 ..... 25 for 5c
1/16x¼ ..... 20 for 5c
2/32x3/32 ..... 40 for 5c
⅛x¼ ..... 12 for 5c
¼x¼ ..... 10 for 5c
¼x½ ..... 5 for 5c
½x½ ..... 4 for 5c

18" BALSA PLANKS
1x1, 1 for 4c
1x2, 1 for 9c
2x2, 1 for 15c
2x3, 1 for 19c
2x6, 1 for 35c

For 36" lengths double above prices and add 10c postage

15" Bamboo Sheet Celluloid Clear Cement
1/16x¼..6 for 5c 2x6 ..... 2c 1 oz. 5c
Shredded..40, 5c 6x8 ..... 4c ½ pt. 25c
Japanese Tissue 12x16 ..... 15c 1 pt. 45c
All colors, Dz. 16c

Clear Dope
Silver or Super-fine Tissue.. 5c Doz. 50c
1 oz. 5c
½ pt. 25c

Colored Dope
Thinner Best
1 oz. 5c
½ pt. 30c

Wood Veneer
20x30", 1 for. 9c
2 for 17c

Reed
1/32, 1/16" (add 5c per inch for props up to 10".)
3 ft. 1c
3 for 2c

Wooden Wheels
½", 2 pair...3c
¾" pair...2c
1" pair...4c
1½" pair...4c
1¾" pair...7c

Celluloid Wheels
¾" pair.....5c
1" pair.....7c
1¾" pair.....9c
1⅞", pair....15c

Balsa Balloon Wheels
½", 2 pair...3c
¾", pair...2c
1" pair...3c
1¾" pair...5c
2" pair...8c
3" pair..14c

PROP. SHAFTS, 2 for....1c

PAUL-O-WINA JAP PROPS
5" 10c
(add 5c per inch for props up to 10".)

Machine Props
5" 4c
(add 1c per in. for props up to 16".)

Rubber Motors
1/16 sq. 20 ft. 5c
⅛ flat ..20 ft. 5c

INSIGNIAS—
French, American, English, German
1½"....4 for 3c
2" 1c
1 sheet of 24, 5c

Dummy Radial Engines
1½" Diam...14c
2" Diam...18c
3" Diam...23c

DOWELS, 1/16x12 10c per doz.

SPOT WELDED HOLLOW ALUMINUM WHEELS
½" .....pr. 8c
1⅛" .....pr. 11c
1⅞" .....pr. 14c

Sheet Aluminum .006...sq. ft. 10c

Alum. Tubing 1/16", 3/16", ¼".....10c ft.

ALUM. LEAF, 2 sheets for 1c

WIRE, 6 ft. 3c 36" lengths.

NOSE PLUGS, large..10c doz. small..5c doz.

Miscellaneous
Washers, ¼, ⅝ doz. 1c
Sandpaper, pkg.5c
Model Pins, pkg. 5c
Brushes No. 6.5c
Thrust Bearings ...1c
Bushings, doz. 3c

Send 3c stamp for "Helpful Hints for Model Builders" and catalog for other bargains. FREE with all orders. ORDERS 75c or under 15c postage. Postage prepaid on orders over 75c. West of Mississippi add 10c extra. Canada add 15% extra.
CASH OR MONEY ORDER—NO STAMPS—NO C. O. D's.

SKYWAY MODEL AIRCRAFT SUPPLY CO. 383 Seventh Ave., Dept. P Brooklyn, N. Y.

NEW CURTISS F11C4 NAVY PURSUIT

28" Span. Length 20½". Weight 4 oz. 1" Scale

THE MOST EXCLUSIVE AND FINEST EQUIPPED MODEL IN THE WORLD

A special De Luxe model, one of the most beautiful and finely detailed ever made, with its special exact scale 3¾" celluloid, 1000 H.P. type, Wright Cyclone motor, having aluminum push rods, cylinder fins, etc., like real motor. Also in set are 4" aluminum cowl rings, 9" carved spruce semi-scale flying propeller, colored star and rudder insignia, 2" celluloid balloon wheels, silver dope, paint, black, red striping, Navy lettering, wire parts formed, axles, rubber motor, windshield, instrument board, flying wires, 4 aluminum step plates, aluminum wing walks, ready cut wheel pants, etc. All other parts printed on balsa. Detail scale drawing.

Construction Set Complete, postpaid..... $4.50

41" LOCKHEED ARMY SPEED VEGA

41" Span. Length 28". Weight 8 oz. 1" Scale

This new model, built very strong yet light in weight, is practically crashproof and will out-perform any large scale model built. Rises from ground in 10 feet and flies over 650 feet. Set contains all parts printed on balsa, ready cut pant cores, 4¼" turned motor front, 11" steel type carved paulownia wood propeller, 2½" balsa wheels, tail wheel, formed wire parts, 28' rubber, 3 oz. yellow dope, 2 oz. blue, ½ oz. black, 2 oz. glue, cement covering, full size scale drawing, and all parts.

Construction Set Complete, postpaid..... $4.95

NEW BOEING P26A ARMY FIGHTER

22" Span. Length 17½". Weight 2½ oz. ¾" Scale

Above photo shows finest equipped model of this plane on the market. Having ready made motor, cowl, prop, etc., it is very easy to build and is a beauty. Const. set contains 3" celluloid motor, 3½" spun tapered aluminum cowl ring, 8" steel type paulownia wood prop, 1⅝" celluloid wheels, tail wheel, insignias, windshield, instrument board, 1 oz. yellow dope, 1 oz. blue, cement, glue, all parts printed on balsa, and drawing.

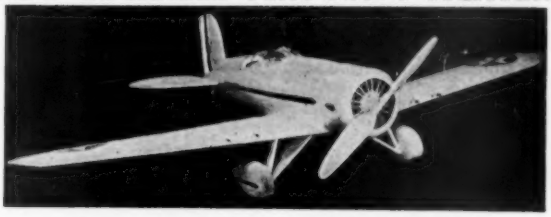
Construction Set in labeled box, postpaid..... $2.75

Same set with completely finished hollow balsa fuselage, wing stubs, headrest, and rubber installed.

Set, postpaid $4.50

Note: In issuing money orders, use St. George, N. Y., postoffice

NEW LOCKHEED P23A NAVY FIGHTER



COMBINATION LAND AND SEA PLANE SET

32" Span. Length 22½". Weight 3½ oz. ¾" Scale

New 4-gun Navy fighter. Model will rise from land or water in few feet. Construction set contains fuselage and pontoon formers, wing ribs, tips, etc., printed on balsa, a 3⅝" turned cowl front, 2 instrument boards, colored insignia, lettering, windshields, 9" carved scale flying prop shown, 3 oz. silver paint, 1 oz. cement, ⅛ oz. black, 2 oz. glue, ready cut wheel pants, strong 2" aluminum wheels, 12 feet of rubber, and large 33"x44" drawing of land and sea plane. This is a sensational model and only one of its type in the world.

Construction Set in labeled gift box, postpaid..... $2.95

NEW BOEING F4B4 NAVY FIGHTER

22½" Span. Length 14½". Weight 2½ oz. Color, Silver and Yellow

This is the finest equipped Boeing, F4B4 model in the world. New improved model exclusively equipped with new 3¼" special aluminum streamline tapered cowl ring, 9 cylinder celluloid motor with aluminum ventilator front, 8" carved varnished propeller, printed out balsa wood parts, silver dope, paper cement, glue, formed wire parts, celluloid wheels, tail wheel, U. S. Navy lettering, colored insignia, and ¾" scale drawing. **Construction Set complete, postpaid..... $2.95**

NEW NORTHROP FT1 NAVY FIGHTER

22" Span. Length 15". Weight 2½ oz. ¾" Scale

A beautiful flying model of the latest Northrop 280 m.p.h. fighter. Set contains 3" turned motor front, 8" carved propeller, insignia, silver, black and clear dope, glue, all parts printed on balsa, full scale drawing, and all parts to build as shown.

Construction Set complete, postpaid..... $2.00

Photo of new type hollow balsa fuselage furnished in set as shown with built-in headrest, wing stubs and rubber motor. This fuselage is part of the $4.50 Boeing P26A Set.

CURTISS HAWK P6E

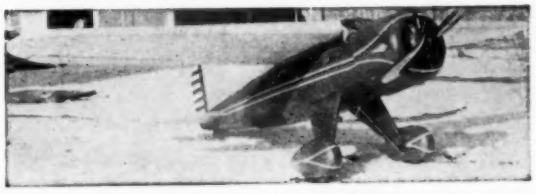
24" Span. Flies 500 Feet.

Const. set contains all parts printed on balsa, blue and yellow dope, glue, drawing, and all parts.

Set, post paid..... $2.50

82" NEW LOCKHEED ARMY SPEED VEGA, 1/5 H.P.

Easy to Build—All Parts Ready Cut Out



82" Span. Length 54½". 2" Scale. Weight 5½ lbs. with motor.

World's finest equipped and most perfect scale gas model

This is an exact scale model of the latest Army Vega, beautifully streamlined. A special de luxe flying gas model with all formers, wing ribs, tips, wheel pants already cut out and notched. Turned balsa motor front, 4½" pneumatic air wheels, silk covering, army blue and yellow dope, glue, etc. Model has removable wing, and is especially designed for gas motor. It is very strong, practically crashproof —there being no exterior parts or struts to break. Takes off in 50 foot run, flies over 1 mile on ¼ oz. of gasoline. Const. set, complete without motor, postpaid $25.00.

1/5 H. P. GAS MOTOR

Weight as shown, 12 oz.

Long life motor has steel cylinder and piston. ⅞" bore x 1" stroke. Comes complete with gas tank, coil, condenser batteries. Price ready to run, complete, postpaid. Only..... **$22.50**

15" or 19" Laminated propeller **$2.75**

CATALOGUE—Send 3c stamp for 8"x10" beautifully illustrated catalogue.

California Dealer: JAYS MODEL AIRCRAFT, 7763 Melrose Ave., Hollywood, California

MINIATURE AIRCRAFT CORP., 83 Low Terrace, New Brighton, New York

Airy Chat

(*Continued from page 12*)

aviation schools such as sponsored by the CCC, the PWA, etc. With all this aeronautical education activity under way, it would seem that the present generation would learn something about airplanes and aviation.

* * *

IF any one should ask me as to the most profitable purpose a privately owned plane could be put, I would immediately say "aerial photography". With the use of a comparatively cheap aerial camera, the enterprising pilot can pick up quite a respectable piece of change, here, there and elsewhere if he can shoot views from aloft.

* * *

SOUTH AMERICA, Mexico and Central America would afford a fine market for planes of all sorts if these fields were properly sold on aviation by responsible manufacturers. In the most part, these countries have very few improved highways in the sense that highways exist in the United States and therefore air is the logical means of transport over the dense forests and the difficult terrain.

* * *

AGAIN, it would seem possible to divert the annual stream of American tourists from the threadbare and wornout European tours to really interesting and instructive air trips through the southern portions of the western hemisphere. There are, of course, several airlines now engaged in this traffic, but the general public still remains uniformed as to the possibilities of such air tours.

* * *

SOME experiments are now being conducted by several American engineers in which the balloon plays the part of a refrigerating or ice machine. Small balloons have been employed to lift small quantities of water and meat up into the altitudes that are below the freezing point. The method of retrieving these balloons after their mission is completed still remains the secret of the engineers.

* * *

THE thought just strikes me as I write about the refrigeration experiment, that this might be the source of free power. For example, when the balloon is brought to earth with the water reduced to the freezing point, there would be a considerable difference of thermal potential between the ice and the surrounding air that could possibly be employed for the production of power. Give this a thought.

* * *

PAUL MANTZ, a leading independent airplane operator on the Pacific coast is teaching blind-flying by a novel method. Pilot Joe James tells of this "crab" method of instruction which is as safe as singing in the bath-tub. Better read this story—it gives a new light on our popular national pastime of blind-flying.

* * *

FROM the great number of replies received to a paragraph in last month's Airy Chat, it would seem that the idea of flying lessons in POPULAR AVIATION is one of the most popular ideas that we have suggested yet. The mail poured in, requesting these lessons so that we'll have to see what we can do about it. And, when we start these lessons, they will be authentic; checked and rechecked by some of the best pilot instructors in the U. S. A.

* * *

WELL, here I am bumping up against the advertisements again, so that is the signal to stop. I'll be seeing you at this same place next month—and so long. J. B. R.

SERVICE FOR PROFITS

SMART DEALERS DEPEND ON DIAMOND

Profits in model airplane supplies are made by fast turnover . . . getting your merchandise fast and selling it the same way. Diamond has a reputation for speed not equalled by any other supplier. That's why the most successful dealers are our customers. Our prices are always low . . . yet we never sacrifice quality for faked bargains. If you want to sell the best parts for the least money ask us to send you a copy of our latest catalog.

If 18" lengths are desired, take ½ of 36" length price.
If 3" widths are desired, double price of 2" widths sheet Balsa. Thinner same price as clear dope.

BALSA
36" LENGTHS PER 100

1/32x1/16 ..... 10c
1/16x1/16 ..... 10c
1/16x3/32 ..... 18c
1/16x1/8 ..... 19c
1/16x3/16 ..... 24c
1/16x1/4 ..... 26c
1/6x1/2 ..... 67c
3/32x3/32 ..... 24c
1/8x1/8 ..... 29c
1/8x3/16 ..... 48c
1/8x1/4 ..... 52c
3/16x3/16 ..... 65c
1/4x1/4 ..... 80c
1/4x1/2 ..... $1.50
1/2x1/2 ..... 2.15

36" PLANS

Scale craft flyer plans with movable controls; Post-Rogers Lockheed or the Monocoupe. $1.50 per doz. or $9.00 per hundred.

36" SHEETS

1/64x2 ....10 for 14c
1/32x2 ....10 for 14c
1/16x2 ....10 for 17c
3/32x2 ....10 for 20c
1/8x2 ....10 for 22c
3/16x2 ....10 for 31c
1/4x2 ....10 for 40c
½x2 ....10 for 75c

BALSA PLANKS
36" Lengths

1x1, each 6c
1x1½, each 9c
1x2, each 13c
1x3, each 20c
1x6, each 35c
1½x1½, each 25c
2x2, each 25c
2x3, each 35c
2x4, each 45c
2x6, each 60c
3x6, each $1.25

COLORLESS CEMENT

1-oz. bots., ½ doz. 23c
2-oz. bots., ½ doz. 40c
4-oz. bots., ½ doz. 70c
1 pt., each 45c
1 qt., each 75c
1 gallon, each...$2.00

CLEAR DOPE OR BANANA OIL

1-oz. bots., ½ doz. 23c
2 oz. bots., ½ doz. 40c
4-oz. bots., ½ doz. 70c
1 pt., each 40c
1 qt., each 65c
1 gal., each....$1.75
Thinner same price as clear dope.

JAPANESE TISSUE

White, per doz...12c
Colored, asst., per doz. 15c
All colors.
Silver, per doz...21c

STANDARD PITCH BALSA PROPELLER BLOCKS
Per Dozen

½x¾x5 ..... 5c
½x¾x6 ..... 6c
⅝x1x7 ..... 14c
¾x1x8 ..... 18c
¾x1x9 ..... 25c
¾x1¼x10 ..... 30c
¾x1¼x12 ..... 35c
1x1½x12 ..... 40c
1x1½x15 ..... 55c

BAMBOO

1/16 sq. x 14, 1 gross for 10c
1/16x¼x11, 1 doz. for 5c

REED

1/32 or 1/16 dia., 50 ft. for..... 18c
3/32 or ⅛ dia., 50 ft. for 20c

ALUMINUM COWLING
Closed or Open

1½" dia., 3 for...25c
2" dia., 3 for...35c
2½" dia., 3 for...43c
3" dia., 3 for...55c
4" dia., 3 for...80c

FRESH PARA RUBBER AAA GRADE
Per 225' skein

1/32 sq. 25c
.045 sq. 35c
3/32 flat 35c
1/8 flat 40c
3/16 flat 70c
Lb., any size...$1.00

DOWELS

1/16" dia. x 12", 100 for 55c
25 for 20c
⅛" dia. x 36", 100 for $1.50
25 for 45c
3/16" dia. x 36", 100 for $2.25
25 for 75c
¼" dia. x 36", 100 for $3.00
25 for 1.00

SHEET CELLULOID
(Transparent)

12½x16, each....19c
6x8, doz. 65c

INSIGNIA SHEET

12 pr. & rudder and tail markings with gummed back. Doz., 36c; 100, $1.75

DUMMY RADIAL ENGINES
(Celluloid 9 cylinders)

1½" dia., ½ doz. for 80c
2" dia., 3 for.....65c
3" dia., 3 for.....85c

CELLULOID MOTOR AND DRAG RING COMBINED

1½" dia. ...3 for 40c
3" dia. ....3 for .75c

NOSEPLUGS, HARDWOOD

1 doz. 5c
100 ..... 40c

CELLULOID WHEELS

⅜" dia., per doz. 24c
½" dia., per doz. 25c
⅝" dia., per doz. 35c
⅞" dia., per doz. 60c

BALSA BALLOON WHEELS
(Machine Turned)

½" dia., per doz. 9c
⅝" dia., per doz. 11c
¾" dia., per doz. 14c
⅞" dia., per doz. 19c
1" dia., per doz. 38c
3" dia., per doz. 85c

BIRCH WHEELS LIGHT AND STRONG

½".....per doz. 5c
⅝".....per doz. 6c
¾".....per doz. 8c
⅞".....per doz. 10c
1".....per doz. 15c

BRASS BUSHINGS OR EYELETS
Per 100

1/16 diam. 12c
3/32 diam. 15c
⅛ diam. 18c

THRUST BEARINGS (Hard Steel)

Small, per dozen. 6c
Small, per gross . 55c
Large, per dozen . 7c
Large, per gross . 70c

WASHERS PER 100

⅛ brass O. D. 5c
¼ copper O. D. 5c

WIRE PER 100 FT.
(Straight Lengths).

No. 6 ..... 15c
No. 8 ..... 18c
No. 10 ..... 20c
No. 12 ..... 23c
No. 14 ..... 26c

SHEET ALUMINUM
Per 5 ft.

.002 thick 35c
.005 thick 50c
.010 thick 75c

ALUMINUM TUBING
(Special 1/100" wall)

1/16 O.D., 5 ft...30c
3/32 O.D., 5 ft...32c
⅛ O.D., 5 ft....32c
3/16 O.D., 5 ft....40c
1/4 O.D., 5 ft....45c

COLORED DOPE

White, yellow, orange, blue, red, green, olive, drab, black, silver, gold or gray.

1-oz. bottles, per ½ doz. 30c
2-oz. bottles, per ½ doz. 55c
4-oz. bottles, per ½ doz. $1.00
1 pt. each.....50c
1 qt. each 85c
1 gallon, each..$2.25

SANDPAPER
5 Pieces to the Pack
Per doz. pkgs....25c

HIGH GLOSS

To shine up colored models.

1-oz. bottles, per ½ doz.....30c
2-oz. bottles, per ½ doz.....55c
4-oz. bottles, per ½ doz. $1.00

CELLULOID PANTS

For ⅜" or 1" wheels, ½ doz. .50c
For 1⅜" or 1⅞" wheels, ½ doz. .75c

¾ FINISHED BALSA WHEEL PANTS
Ready for final sanding

To fit: 6 pr.
½" wheels 36c
¾" wheels 36c
1" wheels 36c
1⅜" wheels 54c
1⅞" wheels 54c

PROP SHAFTS (Hard Steel)
One size fits all models

Per dozen 10c
Per gross 75c

REAR HOOKS (Hard Steel)
One size fits all models

Per dozen 10c
Per gross 75c

DIE-CAST BOMBS

¾" long, 3 for...10c
1¼" long, 3 for...20c
3" long, 3 for...35c

PURSUIT or SWIVEL MACHINE GUNS (DIE CAST)

¾" long, 3 for...10c
1" long, 3 for...15c
1¾" long, 3 for...25c

2-BLADED PROPS (DIE CAST)

1½" long, 3 for...20c
2½" long, 3 for...35c
3½" long, 3 for...45c
4½" long, 3 for...55c

3-BLADED PROPS (DIE CAST)

1½" long, 3 for...25c
2½" long, 3 for...35c
3½" long, 3 for...50c
4½" long, 3 for...60c

DIE-CAST WING AND TAIL LIGHTS
3 Pcs. to a Set

For 12" model, 3 sets 20c
For 15" model, 3 sets 40c
For 24" model, 3 sets 60c

MODEL PINS
Per doz. pkgs....35c

MACHINE CUT PROPS

5"....per doz. 30c
6"....per doz. 38c
7"....per doz. 48c
8"....per doz. 50c
10"....per doz. 85c
12"....per doz. $1.00

WOOD VENEER
(For scale model work)

20"x30", 3 sheets for 25c

GENUINE SUPER-FINE TISSUE

(Cover your champion endurance ships with this paper.)
18x24, per doz...75c

ALUMINUM LEAF

.0003 of an inch thick. 3⅛" wide, 100 ft. for 35c

FRESH RUBBER A GRADE

3/32 flat, skein 250 ft. 20c
⅛ flat, skein 250 ft. 25c

★ ★ ★
FREE DEAL
★ ★ ★

A Big Bonus for a Limited Time Only!

With each order for $2.50 or more of supplies we give free skein of para rubber; regular wholesale price 40c; retail value $1.40 FREE! With each order for $5.00 or more of supplies we give Free—1 skein of para rubber and 2 dozen large insignia sheets. Wholesale price $1.17; retail value about $4.00.

FREE CATALOG
Just off the Press!
Listing everything and anything you may need in model airplane kits and supplies. Everything at rock bottom prices. Get yours today.

HOW TO ORDER
No orders under $2.50 . . . all orders shipped express collect at these low prices.

DIAMOND
Model Mfg. Supply Co.
915 A8 Saratoga Av. Brooklyn, N. Y.

HERE'S YOUR MOTOR!

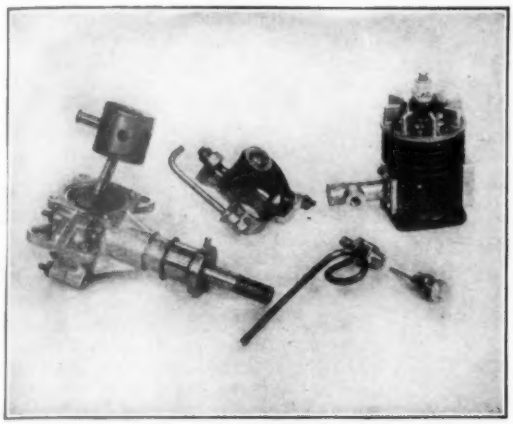
Light weight . . low cost. The Hallman Model B50 develops 50 H.P. at 2000 RPM. Bore 4". Stroke 4¼. Compression ratio 4.8 to 1. Displacement 214 cubic inches. Dry 187 lbs. Complete set of unmachined castings including blue prints can be purchased in three groups at $20 a group.

Write for additional information

HALLMAN AIRCRAFT CO.
694 East 7th St. St. Paul, Minn.

G.H.Q. GAS ENGINES

AN ENGINEERING TRIUMPH . . . *never before at so low a price!*



Indeed an engineering triumph—accomplished by outstanding G. H. Q. designers and engineers, who have constructed into the G. H. Q. "Loutrel" motor everything that years of exhaustive scientific aerodynamic research could produce—geared to the highest possible degree of perfection. But more than that, the acid test . . . an overwhelming response. Thousands of letters are pouring in from all parts of the country praising, recommending, and endorsing this scientific achievement. It seems as if everyone in America wants one. The most hair-raising thrill you've ever experienced will be yours with the G. H. Q. "Loutrel" motor—actually one of the most powerful motors ever constructed. Has broken records for amazing performance . . . and just imagine—flies model planes up to 10 ft. wingspread. Also used for boats and stationary use. Easy to start and simple as ABC to assemble—average assembly time is only 45 minutes. So easy only a screwdriver is needed.

Everything is in the kit including plug, coil, condenser, tank, ignition wire, cylinder, piston, connecting rod, timer, crankshaft, all screws, nuts, bolts, etc. Every part is fully machined and finished. No oil, gas, batteries, or propeller included.

Postpaid for only..... **$8.50**

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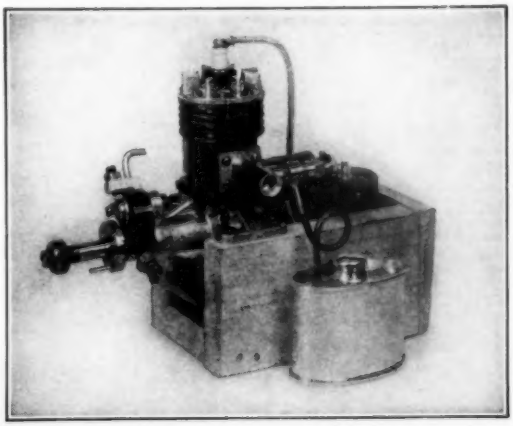

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Hopson

(*Continued from page 25*)

experience for he promptly showed his curiosity by shoving a black head out into the slipstream. Unsatisfied, he swapped ends in Mabel's lap and took a look out the other side.

"Ha!" sneered the rock throwing Mabel triumphantly, yanking him back again. "Looks the same on both sides, don't it? Now sit still before I bend a wrench over your blankety-blank conk!"

Back in the rear pit Ramon had seen what was going on and was grinning his amusement; but a few minutes later the grin was wiped off his face in a hurry when the cub suddenly took a dive into the bottom of the front pit and got himself tangled up in the stick socket.

There was a string of excited Basque, a wild yell from Mabel and the ship began banking off in a graceful downward curve with Ramon fighting the jammed stick and kicking uselessly at the rudder bar.

He got her straightened out, all right, but by the time he did it was too late. He flattened out in a hurry, cut the gun and threw his arm across his face. There came the splintering crunch of a smashed landing-gear, a loud grinding sound and the old Standard came to rest with her belly on the ground.

And that was that.

Oh, yes, they finally did get Beefsteak to the zoo—on a truck—and they were pleased to accept him, bless 'em. I saw him there one day three years later, a grizzled, bewhiskered patriarch, pacing contentedly up and down the length of his comfortable cage; though now and then he'd stop and gaze dreamily off into space.

No doubt he was harking back to the days of his youth when as a frolicksome young cub he dug up gardens and climbed trees and had rocks bounced off his fuzzy conk by a dizzy airplane mechanic.

END.

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Sperry

(*Continued from page 16*)

the glider, he made short hops on a nearby race course.

Shortly thereafter, he built and made short flights in a tractor biplane, motored with a second-hand Anzani airplane engine. In contrast to the then prevailing pusher type of airplane, his first plane was similar in essential design features to a modern biplane.

In the summer of 1913, he enrolled in the Curtiss school at Hammondsport, N. Y., receiving special instruction from Glenn H. Curtiss. Using a Curtiss flying boat he qualified as a hydroplane pilot Oct. 29, 1913, on nearby Lake Keuka receiving F. A. I. license No. 11, which later was extended to cover all types of heavier-than-air equipment.

Impelled by Rodman Wanamaker's proposed trans-atlantic flight in the seaplane "America," he worked with his father and Glenn H. Curtiss at Hammondsport on the two important projects of automatic stability for airplanes in flight and air navigation instruments for prolonged flights.

He was made manager of the aviation department of Sperry Gyroscope Company, Brooklyn, N. Y., and representing his company at the Safety Airplane Contest near Paris, France, June 1914, he won first prize of 50,000 francs with a dramatic demonstration of the stabilizer installed in a Curtiss flying boat.

While Sperry, the pilot, stood up in the cockpit with upraised hands, a heavy man climbed out on one wing, effectively showing that the Sperry gyroscope held the plane on an even keel. Still in France at the outbreak of the World War, he responded to requests of both French and British aviation authorities and gave further demonstrations of the gyro-pilot in France and England. Returning to America in January 1915, he demonstrated the gyro-pilot control to the United States Navy at the Brooklyn Navy Yard.

On Jan. 21, 1915, Lawrence Sperry established a record for passenger carrying in a flying boat from Brooklyn Navy Yard to Ossining, N. Y., and return, completing the 60 miles in one hour and twenty minutes. In 1916, on Sept. 1, he made the first night flight in the United States, flying 50 miles in a Curtiss hydroplane equipped with

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landing lights, from Moriches, L. I., to Amityville, L. I.

He again spent the winter of 1915-16 in Europe demonstrating equipment to the Allies and, upon returning in the spring of 1916, he was increasingly active in tests and practical developments that would be of value to United States combat forces in the event of war.

Lawrence Sperry was the only pilot to volunteer for a series of test night flights for the United States Army, resulting in valuable four-part observations: optical, sound testing, general illumination, and the distances at which an airplane could be apprehended and held in a searchlight beam.

With United States entrance in the war imminent, he was asked to join the U. S. Naval Flying Corps, appointed an Ensign on Jan. 5, 1917, and assigned to U. S. S. Seattle, but was detached on Jan. 20, 1917, for medical treatment and released from active duty. Returning to active duty, June 1917, he supervised important tests of the aerial torpedo which embodied the Sperry gyro-pilot invention.

Sperry vigorously opposed and by his efforts prevented an official ban on "stunting" in the wartime training of American military and naval aviators. Convinced that flyers must know stunt flying for combat purposes, he was the first to loop-the-loop in a hydroplane and at many training centers he demonstrated how to get out of a "tailspin". He also designed, demonstrated and perfected the first pack parachute to be strapped to the pilot for instant use.

Just after the war, he formed the Lawrence Sperry Aircraft Company at Farmingdale, N. Y., where he constructed several planes that embodied his ideas. The first "amphibian" plane, with folding landing wheels, was built here for the U. S. Navy.

The Verville-Sperry racing plane built in 1922, set a world's record for that type of 181 miles per hour around a closed unit at Detroit, Mich., and the following year, after being rebuilt, attained an unofficial speed of 220 miles at Dayton, Ohio.

Most of our lightplane enthusiasts will be particularly interested in the "Sperry Messenger," a very small biplane originally intended for courier service in the Army and for lightplane duties in general. In its general design, it was many years ahead of its time and would pass muster as a modern lightplane even today. It was a tractor type equipped with a three-cylinder radial air-cooled engine of the Anzani type that gave it excellent performance.

Many of his small and compact "Messenger" airplanes were sold to the U. S. Army and Navy. With this latter plane, he was the first to demonstrate on March 8, 1923, at Mitchell Field, N. Y., the feasibility of contacts in mid-air, and his method was adopted by the Army for transferring fuel and supplies while in flight.

In Nov. 1923, Sperry went to Europe to demonstrate his "Messenger" plane and to observe European aviation progress. Flying from England to the Continent over the English Channel, Dec. 13, 1923, his plane fell into the water. An able swimmer, he started for the shore some miles away and was drowned in the rough sea. His body was recovered several days later and returned to America for burial.

He was a member of the Aero Club of America, Aeronautical Chamber of Commerce of America, Cherry Valley Golf Club. During his thirteen years of flying, Sperry spent more than 3,500 hours in the air in every type of aircraft.

END.

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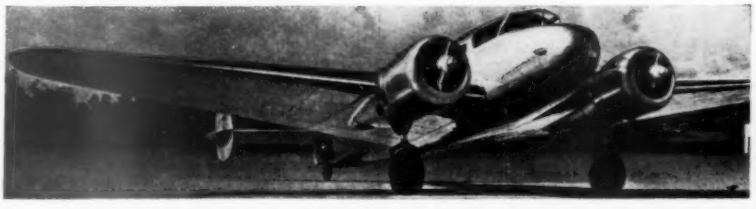

27½" Span. Weight 3½ oz. Color, silver. ½" Scale

Only by producing this model in great quantities are we able to offer it complete at such a low price. It is fully detailed with authentic wing rib and body stringer spacing. Every air-minded boy will want this powerful-looking model. Motor power is run through the fuselage and is concealed—a special feature.

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Gas Model

(*Continued from page 42*)

TUBING

Brass	
6"	2 ⅛" O.D. Fuselage tubing to receive wings
2-3/16"	4 3/16" O.D. Wing sleeves
2"	2 3/32" O.D. Landing gear bushing
2½"	1 ¼" O.D. Tail skid
PIANO WIRE AND ROD	
34"	1 ⅛" Rod iron
24"	1 .040 Piano wire
6"	1 .032" Piano wire
24"	1 .024 Soft wire for bracing rudder and elevator
NAILS, SCREWS, BOLTS, ETC.	
½"	80 No. 18 Wire Nails
⅛"x¾"	4 Round head bolts
⅛"x1"	2 Round head bolts
⅛"x1½"	4 Round head bolts
⅛"x6/8"	6 Round head bolts
⅛"x5/8"	2 Flat head bolts
⅛"x1"	4 Flat head bolts
1"	24 Round head screws
¾ 3" Wheels	2
Bamboo Paper	3 sheets
Celluloid	
8½"x8½"	1
Celluloid	
6"x12"	1

It is understood, of course, that the engine equipment is not included here.

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C-C-C

(*Continued from page 24*)

tions and library work are included in the course of study. Prominent aviation men are invited to visit the meetings of the classes and address the members on many subjects of vital interest.

The last six months' period graduated four students from the complete aviation courses of Arlington University with an average of from 80 to 97 per cent. Camp Arlington can boast of having three pilots who have rendered services in a voluntary manner now residing in camp among whom is the author. At the present time, the author is teaching the ground school courses with the assistance of two former students.

Throughout the entire course of study one point is kept in mind; namely, to provide these earnest young men with the required technical knowledge so as to enable them to become skilled and conscientious aviation workers when they reenter normal civilian life and can be absorbed by the aviation industry.

This is not only directly practicable but has also certain indirect.

Many of these young men are promising material and it is a universal hope that they will be given an opportunity to serve the flying world in the future as their forefathers have in the past.

END.

Transports

(*Continued from page 39*)

has been dealt with, but when one speaks of improving the present transports it is quite evident that unless many other factors are included there could be little accomplished.

More efficient airfoil sections could be used; flush rivets could be employed, if not already included, and a few protuberances (such as radio masts, etc.) could be smoothed up, but that is about all that is left unless the tail wheel is retracted. The argument might be presented that the wing area should be reduced and flaps added to keep the landing speed within the due bounds or that larger power plants should be used to increase the speed, but these items do not contribute to the airplane's cleanness and efficiency.

Some of the other factors not directly contributing to the airplane's efficiency are, such items as passenger comfort, quieting the airplane, heating and ventilating and improving the power plant installation.

When designing for passenger comfort, there is one factor which has not been given a great amount of consideration. It is a well known fact that the faster we travel by air the more severe become the bumps, due to the rough air. It is evident that when speeds of two hundred miles per hour are reached, accelerations due to rough air may become quite high and cause undue discomfort to passengers.

After all, if a traveler can leave New York in the afternoon and be on the Pacific Coast the following morning it may be that a reasonable amount of speed has been attained and our attention can then be turned to passenger comfort. It is possible, of course, to provide some means of absorbing shock due to rough air directly in the passenger seats, but this will be left an open question, indicating the possible influence of speed on passenger comfort as a factor in predicating other improvements.

Regarding quieting of the airplane—a completely silenced plane could, no doubt, be built today if the designer were willing to carry nothing but the means for silencing without payload. Everything that tends toward a quiet airplane adds weight and, therefore, meets with decided disfavor from the designer's viewpoint. Sources of noise include the propeller, engine exhaust, internal engine noises and the passage of the airplane through the air.

The propeller may be quieted consid-

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erably by gearing and using controllable pitch propellers; the engine exhaust may be silenced very effectively if one is prepared to take a big sacrifice in weight; the internal engine noises may be divorced from the rest of the plane by means of shock absorbing engine mounts. The last item,—noise due to passage of the airplane through the air,—probably is low on the present plane due to its cleanness, and any improvement in this direction will only be attained through the plane's refinement.

If quieting the cabin for the passengers is included, it is a well-known fact that noise absorption is directly proportionate to the weight of the absorbing material. As is stated before, it is certain that all items requiring silencing, except the last, will involve considerable weight so that the attainment of a quiet plane depends entirely on how much a designer is willing to pay for this item.

In addition to his other qualifications, an airplane designer must be a heating and ventilating engineer. Not only must he provide plenty of heat for temperatures of forty degrees below zero, but he must provide adequate ventilation above a desert when the thermometer may stand well over one hundred degrees. An airplane cabin is not the best space one could wish for in which to provide good heat and ventilation.

Cabin walls are necessarily thin due to weight restrictions and, therefore, are not good heat insulators. The volume of the cabin per passenger is not large and it therefore requires frequent changes of air. Several types of heating systems now are in use, such as hot air types, with stoves installed on exhaust stacks and several liquid heating types. The latter type seem to be gaining favor and it appears, at present, that a sacrifice of about two hundred pounds or the weight of a passenger and his baggage will have to be made to heat a cabin for twelve passengers.

The problem of power-plant improvement is a subject too great in scope to discuss here in detail. Briefly, however,—a plane engineer is interested in obtaining the most reliable and efficient power-plant available. There are, of course, a great many details which enter into his selection, such as, roughness of the engine and accessibility of the various engine parts and engine accessories which he must install on the plane and which he would like to see as integral parts of the engine. Engine reliability and low weight per horsepower do not go together, so the best and most reliable engine must be selected to suit the particular airplane in question.

The foregoing, while rather general, shows conclusively that the ultimate has, by no means, been reached in our present type transport. Even if the present high speed is satisfactory there is plenty to do with regard to airplane refinement. Perhaps we should hesitate for a moment and give these many details, such as have been commented on, a little more thought, but the engineer is a dreamer and today he has visions of the airplane of tomorrow.

A flying wing wherein all passengers, their baggage, mail, and even the engines might be completely housed, is, perhaps, his vision. This scheme will, no doubt, come with the advent of large airplanes. Then, perhaps, we will go to bed in New York and have breakfast in San Francisco.

But, as in the past, the many unsolved factors such as air line operation requirements and aerodynamics of flying wings, probably will make it mandatory that our next transport airplane will not evidence a very great change from the present type.

END.

Flying Flea

(*Continued from page 20*)

The little cabin job shows about the same general performance except that the top speed is reduced to 15 m.p.h. The power-plant and other equipment remains the same as in the open Flea.

AND NOW FOR THE REAL NEWS. Mignet is now busy building a two-seater Flying Flea of the same general design but much larger than the single-seater. Not much information has yet been released on this latest adventure, but it is entirely possible that we will soon be able to publish the full specifications.

It is rumored that Mignet will visit the United States this fall to supervise the first of the Flying Fleas to be placed into production in this country. This will mark an interesting epoch in the history of American lightplane activities and we trust that the estimated price of $500 for a Flying Flea complete will be an actuality.

It is interesting to note that a Flying Flea Club is being organized in Chicago under the auspices of the Army and Navy Club. The membership of this unit will be limited to 30 members and the fees will be five dollars monthly for three consecutive months. The total sum will then be used for building the latest type Flying Flea which will be kept at a North Side flying field. Instruction will be by the official club pilot.

END.

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RAS

Gates Circus

(*Continued from page 30*)

he had said. I knew his colorful language by heart. He had been taking a nap in the tent and was rudely awakened by my dives. After discovering what was going on, he eagerly watched the outcome, forgetting entirely his interrupted beauty nap.

Realizing I had only one more dive in which, not only I could win my bet, but to safeguard the zealously built reputation as a pilot, I dove down for the third time upon the innocent banner. The whining shriek of the motor and the wind roaring through the struts sent many a head jerking in fearful anticipation toward the clear sky. But as I pulled up sharply, I noticed most of the flag was neatly wedged around my inner bay strut, and I grinned confidently. Only a small ribbon remained of the flag. I had cut off the staff with the flaming emblem as though with a knife.

When I got down to claim my reward, Roy, staring at the remaining ribbon above the tent, remarked excitedly,

"I'll bet you ten bucks now, that I can take that ribbon off in three dives."

Well, that was sporting enough, I decided and secretly thought I should raise the amount, but I let it go and watched Roy get into position for his dive.

Well, Roy came down all right, his ship making enough noise to surpass a troop of elephants chasing after Johnny Weissmuller, and whether by sheer luck, accident, ability or that same Act of God that's the best excuse anybody ever knew, took the ribbon and the rest of the staff like George Washington handled his famous cherry tree. And on his first dive, too. I congratulated myself mentally that I did not raise the bet and kissed my five-spot a gallant farewell.

Seeing such an exhibition of nerve and flying skill—though it was really a stunt by a couple of lunatics with a lazy hour to spare—one of the spectators, a prominent doctor in Troy, invited all the pilots to the Hendrix-Hudson hotel for dinner that night. He probably thought twice before he handed out a second invitation like that, because the best thing we could do next to flying was to eat.

Some time after that we reached the wealthy and affluent city of Pittsfield in Massachusetts, and I still remember that town because we all put in the hardest work we had done in our whole careers with the Flying Circus. Our smart advance man or press agent, George Daws had arranged for the greatest publicity of the year for the outfit.

Our pictures, stunts, individual biographies, down to our intimate likes or dislikes were plastered all over the front pages of the local newspapers. It was little wonder that when we got started to do our stuff the small hillside field was surrounded by a huge crowd. Pangborn, McKinney, Roy Ahearn, Lee Mason and I worked there like a bunch of pack horses for the Italian engineers in Ethiopia, and we certainly had to do it without any quibbling, considering the conditions and the enthusiasm of that mob.

It was one of those sultry September days, and what with the gusty air, trees, wires, two small lakes around the field and several huge boulders and stones on the airport, it taxed our skill and endurance to the limit. The steady merry-go-round of five planes started early in the morning.

For the first two hours we all took our regular turns and kept flying with capacity loads. The corral was always filled with waiting passengers and at no time did we have less than $300 worth of rides sold in advance. The way those people kept pouring in and out of the ships looked like a swarm of ants let loose on a pot of honey.

The first one to drop out was Roy Ahearn with a broken camshaft gear, Roy the mystery man with his bum luck and his miraculous escapes. A little later Lee Mason sat down with an overheated radiator and it was two down with the bases filled. While they struggled desperately to get their ships into action for this sweet picking, Pangborn, McKinney, with his big Liberty Curtiss R, and I worked like hobos at a free lunch counter.

It was McKinney who took the honors for the shortest flight on record—all of forty-five seconds. He simply swooped up and bounced right back again like an autogyro.

When you stop to consider that rides in those days sold for between $2.50 to $5.00 each and every ship carried not less than four passengers, those were precious, mercenary seconds indeed, not only for the passengers, but ourselves as well. By four o'clock McKinney was leading the field with a sweet $500 taken in with his ship. As it wouldn't get dark until nine-thirty, Mac kept muttering to himself like a rehearsing bridegroom,

"A thousand dollars or bust."

But unfortunately, it wasn't the thousand dollars. It was bust. For not very long after his brave decision, Mac's ship folded up. His Liberty burned out a piston.

That left only Pangborn and me in the running. Soon after Mac's swan song I broke a shock-cord on my landing-gear but with Nick's able help, I was going strong again in five minutes. But at this point minutes actually meant plenty of dollars.

That evening, when the final check-up was made after surely the hardest day's work in the history of any barnstormer, I emerged with an even $700 taken in that day with a total of ninety-four take-offs.

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dening day's work, but it certainly was worth it. Even though George Daws relieved me of twenty-five bucks that night in a mild game of poker, I felt still 'way ahead of the game.

My receipts held the record all that year, only to be broken the next season by Bill Brooks in the Carolinas. Bill toted 900 passengers at $1.00 a ride in one day, and looking back on my own record-breaking day's performance, I'm sure he's welcome to the title.

While the rest of the outfit remained after our tumultuous reception in Pittsfield, Pangborn and I proceeded on to Greenfield, Mass., and carried about a thousand passengers there. Encouraged by our equally stupendous success here, and no doubt dreaming about Hollywood's ideas of colossal publicity stunts —George Daws again booked the Circus for a return engagement the following week-end.

This was truly an outstanding performance even for those days when aerial circuses and barnstorming carnivals had the public interest up to its highest pitch.

When the proceeds were counted up for the week, Pangborn had over $5000 in his suit case. We carted around thousands of dollars loosely packed into suitcases in the same way the greaseballs tossed around their necessary tools. The consensus of opinion among the boys was, that in case of an emergency like an attempted hold-up we could always pick up and fly.

END.

Swanee Taylor

(*Continued from page* 19)

As for the treason part—anybody can make the most of it. I still contend that we, as a generation, failed to achieve the ultimate in proper popularization of aviation in a world long hungry to fly. Oh, I know, there were lots of good reasons why we failed; the struggle for existence, preoccupation with development, the depression and several other excellent alibis.

None-the-less, fail we did and excuses don't count. For my part, I'd like to see aeronautics become the one human enterprise where excuses won't be tolerated—where accomplishment only will be accepted.

Therefore, if it be treason for me to look for less than perfection then get your guns down out of the racks and stand-by to make the most of it. I'll be seein' ya at dawn.

All of which leads up to. . . .

Possibly the cause for my seeming bitterness is that I have always been able to look ahead a bit into the future of flying. (How they laughed, in Atlanta, when I told them they'd soon have lunch at home and see a show in New York that same night!) Mayhap I'm somewhat subconsciously sore because I sat in at the birth of commercial aviation and got to nurse the sickly infant through a lot of colic and change plenty of diapers. These new people coming in now meet the sweet young girl at graduation and walk off with her down Life's highway. It makes you feel sorta like a fond mama when her oldest daughter gets married and goes away!

But, I suppose, like fond mamas the world over we oldsters will dry our tears and pick up interest again when the grandchillun begin to land. And what grand grandchillun they will be!

Of this we can be more than fairly certain. For, in the recent H. G. Wells motion picture, "Things To Come" we have a remarkable forecast of what may be expected of Aviation-grown-up. Mr. Wells will never know, unless he lives to be a hundred, just what profound depths he touched with his prophetic theme, Flying, Civilization's Salvation.

All who saw the picture will remember his portrayal of a world gone mad from an overdose of "Idealistic," which is to say screwball, political philosophy. And when the last shred of humanity dangled precariously at Man's waist, with animalism but a short step away, united aviation suddenly came to the rescue. It was "Wings Over The World," a potent, irresistible force, that restored law and order, saved the species from stark savagery and set mankind once more on the path to greater and happier times.

Unity is a beautiful word—forceful and easy to say. Our aeronautical grandchildren, I hope and trust, will appreciate its meaning, and subscribe to its definition far more sincerely than have we.

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Bill Cooper

(*Continued from page 24*)

writer pounding out aviation gospel—unless he's out at some airport with his expensive candid camera. I should say "could have found" unless you, dear reader, happen to live in Hollywood or Los Angeles. For, by the time this issue of POPULAR AVIATION reaches the newsstands, Bill Cooper will be in Hollywood where he will do his stuff for aviation through scripts for the movies. One big producer already has purchased one of his stories and others are on their way.

Practically every available aviation publication graces the Cooper desk. This will sound fishy but I swear it's on the level.

And reading the current aviation magazines is not his only method of contacting the industry. Editors of aviation magazines and aero-engineers well know the tones of his dulcet tones, asking for information or else checking and counter-checking other sources of information. Above all, Bill is accurate and Flying Time is therefore a dependable bit—not simply the brainstorm that some broadcasts have been. And he is particularly keen on war air history and the utilization of the airplane.

Bill's favorite aviation magazine is POPULAR AVIATION. He's been reading P.A. steadily for several years and claims it's the only magazine that does what it claims—popularizes aviation.

Though Bill's in Hollywood he will continue to write Flying Time and Lights Out. Which will keep him an eligible member of the Chicago Sitting Down Club.

Toward the end of our feet-on-desk interview I managed to sneak in that age-old reporters' bromide: "What's the secret of your success?"

"Well," Bill sort of grinned, "I just ask all the men, women, lads and gals I can find what it is they want to know about aviation, regardless of what phase of the industry it is. I jot their questions down on a scratch pad and later write the detailed answers into my earliest possible script of Flying Time."

Drop him a note and see for yourselves.

(EDITOR'S NOTE. *Since this article was written, the Sitting Down Club has merged with the Sons and Daughters of Sitting Bull*).

END.

Flying Schoolroom

(*Continued from page 16*)

place like this. I was a stranger here.

I had wondered how I would react to a long flight by radio and instrument, and I soon found out: I was too darned busy to worry. I just sat there, listening to the monotonous on-course signal, bringing the ship back on course whenever I wandered into the "A" or "N" sector, until at last we flew over the cone of silence. It was then an easy matter to locate the field.

After gasing up at Cleveland we took off and climbed through the overcast, where we flew on top at 7,000 ft. against strong head winds all the way to Chicago. This was a very lovely sight, though a bit tiresome after four hours steady of nothing but clouds on every horizon.

The only friendly thing we saw on the way was an American Airlines Douglas DC-2 coming in from Detroit, and following along on the Goshen beam with us. Needless to say, it was by us and over the horizon in no time. The clouds were broken and visibility good at Chicago, so there was little difficulty in getting into the airport.

The return trip out west was similiar to the eastward passage except for the more numerous gas stops due to prevailing westerly winds. We stopped at Des Moines, Omaha, North Platte, Cheyenne (over night), Salt Lake, Elko, Reno, and home. Everything seemed to operate smoothly the whole trip except for minor radio trouble, and I'm certain that all the boys got a general idea of what airline flying was like, and the importance of being accurate and positive in every procedure.

No amount of "schooling" could have so impressed seven students as did following the beam through thick stuff and on top. Nor was that all. We found we actually could follow strip maps, thereby improving our ability to establish positions; intelligently ask for and use weather information; make radio reports; hold the big ship at specified altitudes and speeds, and on course; handle the engine economically.

And we got the idea, too, that, given time and experience, we might eventually become pilots.

END.

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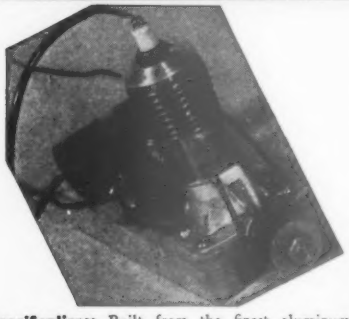

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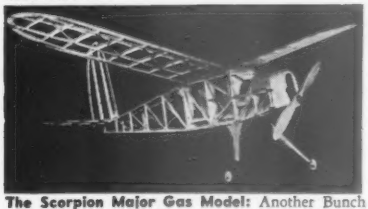

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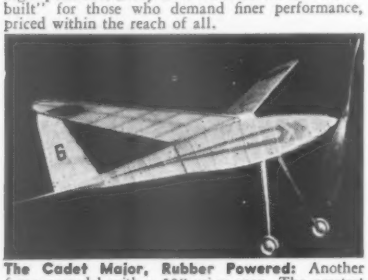

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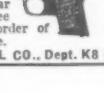

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Landing Gear

(*Continued from page 38*)

drag due to the landing-gear without wheel-pants amounted to approximately 21 pounds at 100 m.p.h. and when equipped with pants offered only 15 pounds of drag.

The chief disadvantage of wheel-pants has been the trouble caused when a wheel has to be removed or the tire changed. In Fig. 5b part of the fairing of the pant has been left off so that the wheel could easily be slipped off its axle without removing any part of the pant. This arrangement has proven very satisfactory as the advantages of this type out-weigh the little additional drag that is created.

Obviously, such points as cost, construction facilities and constructional ability have to be considered. Such features as mono-strut chassis, pants, etc., are often out of the reach of the amateur because of the above mentioned reasons.

Possibly, the spring-leaf tail-skid is the most commonly used type of skid on lightplanes because of its low drag, simplicity of construction, and low weight. The tail skid illustrated in Fig. 6 is a typical example. A cast iron shoe may be added for use on concrete runways.

Tail-wheels are not necessary on lightplanes and the extra weight added due to the type of installation necessary offsets the advantages of a wheel. Tail-wheels are generally preferred on all types of military planes because they permit easier handling in the hangar and on the line.

The wheel must be designed so that it can revolve 360-degrees on its vertical axis to prevent stresses imposed upon the airplane structure when handled in unusual ways. Various types of streamlined skids have been devised but are not very satisfactory on lightplanes.

Shock-absorbing wheels and brakes are both advantageous on any airplane but the absorber contained wheels have not proved themselves entirely satisfactory. The cost of brakes is somewhat out of reach of most builders and if they are to be had, care must be taken in their installation. The manufacturer can furnish complete data for installing them.

As elsewhere stated, the wheels must be placed well forward of the c.g. to prevent nosing over. This is likely to happen if the brakes are applied suddenly. New types of wheels are continually being devised which are supposed to have much less drag for a strength/weight ratio. Better materials and sounder construction is continually sought.

The use of skiis permits the airplane to be operated in deep snow where it would be impossible to operate with wheels. The present type of ski is heavier than the wheel it replaces and offers greater drag, therefore the performance of the airplane is reduced. Some of the newer designs are retractable or well streamlined.

The skiis should be so designed as to allow a longitudinal rocking of the plane from horizontal to 18-degrees tail-low and must be equipped with an elastic support that will hold their bows up against the air stream at the maximum diving speed.

Since the chassis offers quite a large portion of the total drag of the airplane, the retractable landing gear has been used almost entirely on commercial planes recently. The lightplane has seldom been provided with such a chassis as there is not enough room in the fuselage to house the wheels and struts and the structure is too heavy.

Recently, some lightplanes employing a deep fuselage have been equipped with such a chassis. It is desirable to have such a landing-gear if possible as is to be seen in the following example.

The Verille-Sperry racer had a maximum speed of 162.8 m.p.h. with the chassis extended and 191.1 m.p.h. with it retracted. If this type chassis is employed a simple rugged mechanism must be designed.

The chassis must be almost uniform in strength at all points; this is especially true of the wheels. All members should meet at large angles both from an aerodynamic and structural viewpoint.

At points of unusually high stress the member should be reinforced. The axle may be reinforced by inserting a smaller tube inside the axle tube. Wheels and axles should be provided with grease fittings. Eccentricities of the landing-gear should be avoided. Shock absorbers should be placed in the wing or fuselage to reduce the drag.

END.

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1/16x1/8...40 for 5c
1/16x1/8...20 for 5c
1/16x1/4...16 for 5c
1/8x1/8...32 for 5c
1/8x1/4...30 for 5c
1/8x3/8...15 for 5c
1/8x1/4...10 for 5c
1/8x3/8....8 for 5c
1/4x1/4....6 for 5c
1/4x1/2....5 for 5c
1/4x1/2....3 for 5c
1/2x1/2....2 for 5c
36" Lengths, add 10c for packing.
1/16 or 1/8x2..8—10c
1/4 or 3/8x2..6—10c
1/4x2....6 for 10c
3/8x2....3 for 9c
1/4x2....3 for 10c
1/2x2....1 for 6c
3" sheets double these prices.
1x1.. 4c; 2x2 18c
1x1½ 8c; 1½x2 5c
1x2.. 10c; 1x3 15c
2x3.. 23c; 3x3 40c
2x6.. 35c; 3x6 55c

TISSUE, AA
All col., doz. 18c
Silver, each...4c
Superfine, white.....5c

WHEELS
Wood Balsa Cell.
½ .01 .02
¾ .02 .03 .05
1 .03 .04 .07
1¾ .01 .06 .10
1⅞ .07 .08 .16
3 .15 .30

NOSE BLOCKS
1x2x5 .....1c
2x2x1 .....2c
2x2½x1..... 3c
3x3x1..... 5c
3x3x2..... 8c
3x3x3..... 10c

INSIGNIA
24 and stripes 5c

WASHERS
1 doz. ¼ or ¾ 1c

SHEET ALUMINUM
.0003x3½...ft. 1c
.005 in. 6x6...5c
.010 in. 6x6...6c

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1 oz. 5c; 2 oz. 7c; 4 oz. 13c; ½ pt. 25c; pt. 45c.

THINNER
Same as clear dope

COLORED DOPE
1 oz. 5c; 2 oz. 9c; 4 oz. 17c; ½ pt. 35c; pt. 55c.

PROPELLER BLOCKS
½x ¾x 5.....
.....8 for 5c
½x ¾x 6.....
.....6 for 5c
⅝x1 x 7.....
.....4 for 5c
⅝x1 x 8.....
.....3 for 5c
¾x1¼x10.....
.....2 for 5c
¾x1¼x12, ea. 3c
1 x1½x12, ea. 4c
1 x1½x15, ea. 6c

CLEAR CEMENT
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20x30....1 for 8c

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6x8 .....5c
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3" dia. 35

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1¼".. 5c 08
2¼".. 10c 10
3½".. 15c 20
4½".. 20c 25

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ALUM. COWLINGS
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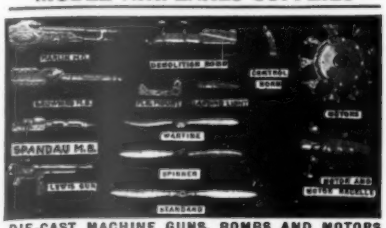

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Model Department

(*Continued from page 47*)

short projecting rods to represent the ends of the exhaust pipes are also details that should not be overlooked.

LANDING-GEAR DETAILS

The landing gear is of the self-supporting cantilever type consisting of two streamlined balsa struts which are faired into the body by stiff paper fillets. Particular attention should be paid to the use of the piano wire reinforcements at the point where the struts attach to the fuselage. The use of a 1/32-inch strip of sheet balsa as a stiffener at this point is clearly shown in the landing gear details. This sheet of balsa also serves as a base for attaching the piano wire reinforcements.

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